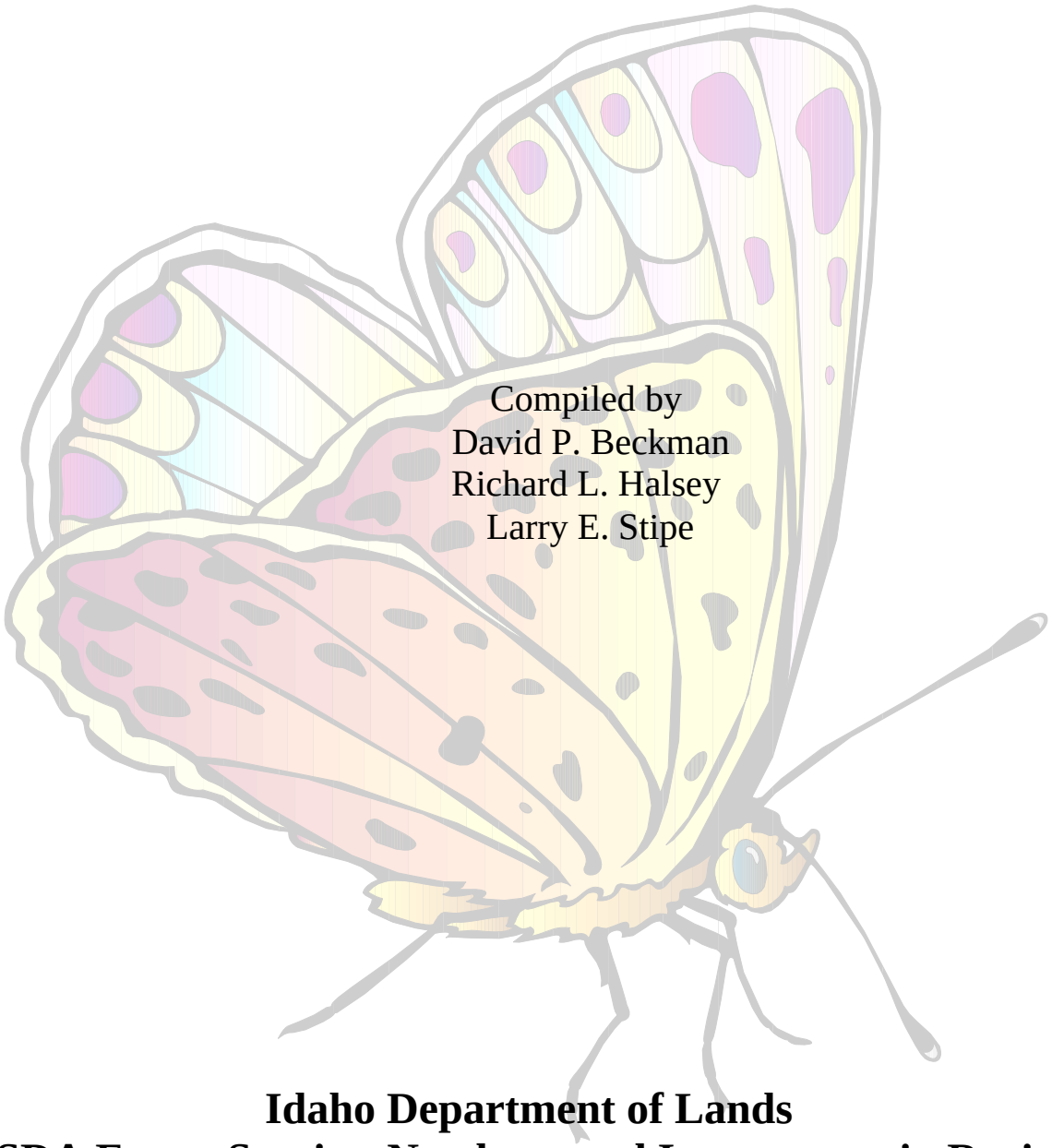
IDAHO FOREST
INSECT & DISEASE CONDITIONS
1999-2000



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INTRODUCTION

This report summarizes major insect and disease activity on forested lands of all ownerships within the State of Idaho for 1999 & 2000. Much of the information for this report was derived from aerial and ground surveys and associated detection and evaluation activities by insect and disease specialists within the USDA Forest Service and the Idaho Department of Lands. Acres and numbers of trees reported in tables are only estimates. Likewise, maps outlining areas of major insect infestations only provide general locations of defoliation and mortality.

Forest insects, bark beetles and defoliating insects are featured in this report because they commonly occur as "outbreaks" and are readily observed from aerial surveys. Effects of most significant forest diseases are not readily assessed from the air. Therefore, only general information and observations on diseases are reported.

Insects and diseases affect the health of forests in many ways. A broader, more comprehensive discussion of these effects and their significance is contained in "Health of Idaho's Forests, A Summary of Conditions, Issues and Implications." National Forest designations include all adjacent state and private ownerships as well as federal lands.

CONDITIONS IN BRIEF

FOREST INSECTS

Tree mortality attributed to mountain pine beetle increased throughout Idaho for the past two years with 127,600 dead pines detected in 1999, 485,950 in 2000 in all pine species, on all ownerships. The largest outbreaks were located on the Nez Perce National Forest in 1999 with 50,200 dead lodgepole pine and in 2000 with 234,300 dead lodgepole pine; also in 2000 there were 116,600 dead lodgepole pine on State and private lands around Elk City, Idaho. Tree mortality attributed to pine engraver beetle and western pine beetle also decreased throughout Idaho in 1999 and 2000 with 15,500 in 1999, and only 2,700 in 2000 in all tree species, on all ownerships. The largest outbreaks were located on the Coeur d'Alene National Forest reporting area in 1999 with 8,000 dead lodgepole and ponderosa pine. Tree mortality attributed to spruce beetle decreased throughout Idaho in 1999 and 2000 with only 302 in 1999, and then increased in 2000 to 2,400 dead spruce on all ownerships. The largest outbreaks were located on the Targhee National Forest in 2000 with 700 dead spruce trees. Tree mortality attributed to Douglas-fir beetle increased throughout Idaho from 90,000 in 1998 on all ownerships, to 398,600 dead Douglas-fir in 1999 and to 393,800 dead trees in 2000. Reported dead trees would have been higher if all forested areas had been flown in 2000. The largest outbreaks were located on the Coeur d'Alene National Forest in 1999 with 131,300 dead Douglas-fir and another 105,200 dead trees in 2000. Tree mortality attributed to the fir engraver decreased throughout Idaho from that 10,300 in 1999 and a large decrease to only 2,800 in 2000 on all ownerships. The largest outbreaks were located on the Coeur d'Alene National Forest in 1999 with 2,900 dead grand fir and another 2,500 dead grand fir on State and Private lands. Tree mortality of subalpine fir was divided between north and south Idaho with the mortality attributed to western balsam bark beetle all in the north and tree mortality in southern Idaho attributed to a complex of subalpine fir mortality agents. Tree mortality attributed to western balsam bark beetle increased throughout Idaho in 1999 and 2000 with 30,000 in 1999 and another 45,000 in 2000 on all ownerships. The largest outbreaks were located on the Kaniksu and Nez Perce National Forest in 2000 with each having about 16,000 dead subalpine fir trees. Tree mortality attributed to the subalpine fir complex also decreased in 1999, then increased throughout Idaho in 2000 with approximately 5,000 dead trees in 1999 and 13,700 dead trees in 2000 on all ownerships. The largest outbreaks were located on the Targhee National Forest in 2000 with 5,000 dead subalpine fir trees. There was no visible defoliation from Douglas-fir tussock moth in Idaho during 1999 but in 2000 there was 54,753 acres of defoliation near the town of Potlatch, Idaho on the Palouse Ranger District of the Clearwater National Forest and adjacent state, private, and reservation lands. There was no visible defoliation from western spruce budworm in 1999 and 2000. Subalpine fir mortality due mainly to the balsam woolly adelgid was mapped over 53,400 acres in 1998, 96,070 acres in 1999, 56,426 acres in 2000 mostly on the St Joe, Clearwater and Nez Perce National Forests and adjacent state, private and BLM lands. The change in acres infested by BWA can be attributed to changes in areas surveyed and abundance of visible recently killed trees. The distribution of BWA does not significantly change from year to year.

FOREST DISEASES

Forest disease mortality is not usually as apparent as insect outbreaks or forest fires, so the extent of losses is difficult to measure accurately. Even though impacts may be quite severe over time, the aerial surveys which provide most of the data for this report do not usually record these diseases because they are so difficult to detect from the air.

FOREST INSECTS

BARK BEETLES

MOUNTAIN PINE BEETLE

Mountain pine beetle (MPB) is a native bark beetle that attacks lodgepole, ponderosa, western white, and other pines. The beetle ranges throughout western pine forests from Canada into Mexico. Beetles infest mature and overstocked stands of pines.

1999 - In Idaho, mortality increased for the fifth straight year with 127,600 trees killed (Table 1, Figure 1) on 83,800 acres compared to nearly 85,000 trees killed in 1998. Mortality occurred in all pine species, lodgepole, ponderosa, white pine, and whitebark pine. Almost ninety percent of beetle-killed trees (111,700) were lodgepole pine. Beetle populations have taken advantage of increasing amount of susceptible lodgepole pine, in and favorable weather conditions over the past several years. Populations remain quite active, and may be expected to increase through out Idaho. The largest outbreak in Idaho located on the Nez Perce National Forest in lodgepole pine with just over 50,200 trees killed (Table 1) on 26,000 acres. Numerous large groups of mountain pine beetle-killed lodgepole pine were mapped within the St. Joe National Forest reporting area with just under 29,000 trees killed. Groups of mountain pine beetle-attacked western white pine were also found scattered throughout northern Idaho. White pine blister rust (BR) is likewise extensively found throughout much of northern Idaho. While there may often be an association between mountain pine beetle and BR-caused mortality, it should not be inferred that it is an obligatory one. Mortality of whitebark and limber pine attributed to mountain pine beetle infestation continued to increase in 1999, to just under 12,000 trees killed (Table 1, Figure 1). The largest concentration of red trees were located on the Kaniksu and Payette National Forest reporting areas with almost 5,000 trees killed on both National Forest (Table 1). Small, isolated infestations are located on other Forests, BLM lands and State and Private lands. Increasing MPB mortality levels were observed in southern Idaho. The largest outbreaks in southern Idaho were located on the Sawtooth, and Salmon-Challis National Forests in lodgepole pine with a combined total of 13,300 trees killed. In Southern Idaho mortality of whitebark and limber pine attributed to mountain pine beetle attack increased from 3,200 trees killed in 1998 to 5,500 trees killed in 1999. While mortality was observed throughout the host type greatest mortality was located on the Payette National Forest with 4,800 trees killed on 5,200 acres.

2000 - In Idaho, Mountain pine beetle populations once again increased significantly, for the sixth straight year. In 1999, nearly 83,800 acres (Table 1) were infested (about the same acreage infested in 1998), on which an estimated 127,600 trees were killed (Table 1, Figure 1). In 2000, almost 486,000 trees were killed (Table 1, Figure 1) on approximately 123,200 acres (Table 1)--including all host species, found on lands of all ownerships. Almost 93 percent of mapped beetle-killed trees were lodgepole pine. The largest outbreak in Idaho exists on the Nez Perce NF in north-central Idaho, where on slightly less than 66,000 acres, 234,300 red lodgepole trees (Table 1) were mapped. The most seriously affected stands were on, State and Private lands where on only 3,700 acres, (Table 1) 118,700 trees were killed, with an average thirty two trees per acre being killed. Mortality of whitebark and limber pine attributed to mountain pine beetle infestation continued to increase in 2000, to just over 24,200 trees killed (Table 1, Figure 1) on 11,700 acres. The largest outbreak was located on the Kaniksu National Forest with just over 17,200 trees killed (Table 1) on 8,600 acres, not far south of the US/Canada border. Beetle-caused mortality in ponderosa pine stands, is not extreme; but is of concern in some areas. The largest outbreaks in southern Idaho were also located in lodgepole pine stands on the Sawtooth National Recreation Area and Salmon-Challis National Forests in central Idaho with a combined total of 20,000 trees killed, on 9,200 acres. Impact was most severe along the Salmon River and Redfish Lake where killed lodgepole provided shade and scenic beauty for recreationists as well as shade to moderate temperatures for spawning endangered salmon species. Mortality of whitebark and limber pines attributed to mountain pine beetle attacks in southern Idaho continued in 2000 with 6,600 trees killed, on 2,900 acres, up from 5,500 trees killed in 1999. Most of this mortality was in high elevation whitebark pine stands in southern Idaho where the rare pine stands are declining from a combination of: white pine blister rust infections; interruption of normal fire cycles; invasion of shade tolerant species and consequent overstocking; over maturation of stands; and the mountain pine beetle. These high elevation ecosystems are highly valued and important for watershed stability, recreation, and wildlife purposes. The heavy whitebark pine seeds are also an important food source for numerous birds and small mammals, as well as food for the threatened and endangered grizzly bear.

Table 1. Idaho Statewide summary; annual mountain pine beetle (**MPB**) mortality

		MPB (white pine) Estimated Mortality			**MPB** (ponderosa pine) Estimated Mortality			**MPB** (lodgepole pine) Estimated Mortality			**MPB** (whitebark pine) Estimated Mortality		
AREA	Year	Acres Infested	Trees	MBF Volume	Acres Infested	Trees	MBF Volume	Acres Infested	Trees	MBF Volume	Acres Infested	Trees	MBF Volume
Bitterroot	2000	0	0	0.0	0	0	0.0	0	0	0.0	0	0	0.0
	1999	0	0	0.0	107	371	29.7	2	10	0.9	14	24	2.6
Boise	2000	0	0	0.0	0	0	0.0	387	844	50.6	456	763	83.9
	1999	0	0	0.0	100	140	5.6	125	175	10.6	435	482	53.0
Caribou	2000	0	0	0.0	0	0	0.0	279	717	45.9	10	25	2.8
	1999	0	0	0.0	105	105	4.2	130	203	13.0	0	0	0.0
Clearwater	2000	180	159	63.6	6	3	0.2	2,255	1,825	164.3	4	2	0.8
	1999	213	202	80.8	2	1	0.1	685	640	57.6	2	5	2.0
Coeur d'Alene	2000	1,092	696	278.4	19	50	4.0	941	1,784	160.6	0	0	0.0
	1999	342	455	182.0	99	51	4.1	503	2,276	204.8	2	5	0.6
Kaniksu	2000	1,510	940	376.0	315	145	11.6	5,945	7,280	655.2	8,601	17,202	6,880.8
	1999	1,035	977	390.8	45	110	8.8	2,658	9,293	836.4	7,021	4,955	1,982.0
Kootenai	2000	207	265	106.0	98	108	8.6	190	325	29.3	0	0	0.0
	1999	24	26	10.4	2	10	0.8	0	0	0.0	0	0	0.0
Nez Perce	2000	0	0	0.0	714	2,600	208.0	65,723	234,341	21,090.7	133	165	66.0
	1999	4	10	4.0	2	5	0.4	26,043	50,256	4,523.0	631	436	174.4
Payette	2000	0	0	0.0	10	20	0.8	440	975	62.4	1,456	3,968	436.5
	1999	0	0	0.0	60	84	3.4	473	411	26.3	5,202	4,808	528.9
Salmon-Challis	2000	0	0	0.0	0	0	0.0	2,233	4,722	302.2	184	676	74.4
	1999	0	0	0.0	95	133	5.3	5,171	7,084	453.4	0	0	0.0
Sawtooth	2000	0	0	0.0	0	0	0.0	7,030	15,281	978.0	10	14	1.5
	1999	0	0	0.0	0	0	0.0	4,212	6,207	397.3	25	51	5.6
St. Joe	2000	424	438	175.2	4	10	0.8	9,065	19,460	1,751.4	0	0	0.0
	1999	276	167	66.8	3,591	972	77.8	18,374	28,816	2,593.4	0	0	0.0
Targhee	2000	0	0	0.0	0	0	0.0	35	100	6.4	784	1,190	130.9
	1999	0	0	0.0	0	0	0.0	15	21	1.3	80	112	12.3
Indian Res.	2000	0	0	0.0	0	0	0.0	45	115	6.9	0	0	0.0
	1999	0	0	0.0	2	3	0.2	30	45	2.7	0	0	0.0
BLM	2000	60	35	14.0	0	0	0.0	173	470	32.2	20	64	7.0
	1999	0	0	0.0	0	0	0.0	1,718	1,792	159.6	295	343	37.7
Other Lands	2000	258	274	109.6	115	4,821	385.7	3,685	118,766	10,688.9	33	30	3.3
	1999	103	108	43.2	49	87	5.6	3,530	4,524	388.5	186	614	216.9
Idaho Totals	2000	3,731	2,707	1,082.8	1,283	7,722	616.8	106,487	451,314	39,927.2	11,724	24,214	7,709.3
	1999	1,997	1,945	778.0	4,259	2,072	145.9	63,669	111,753	9,669.7	13,893	11,835	3,024.4

Idaho MPB Mortality

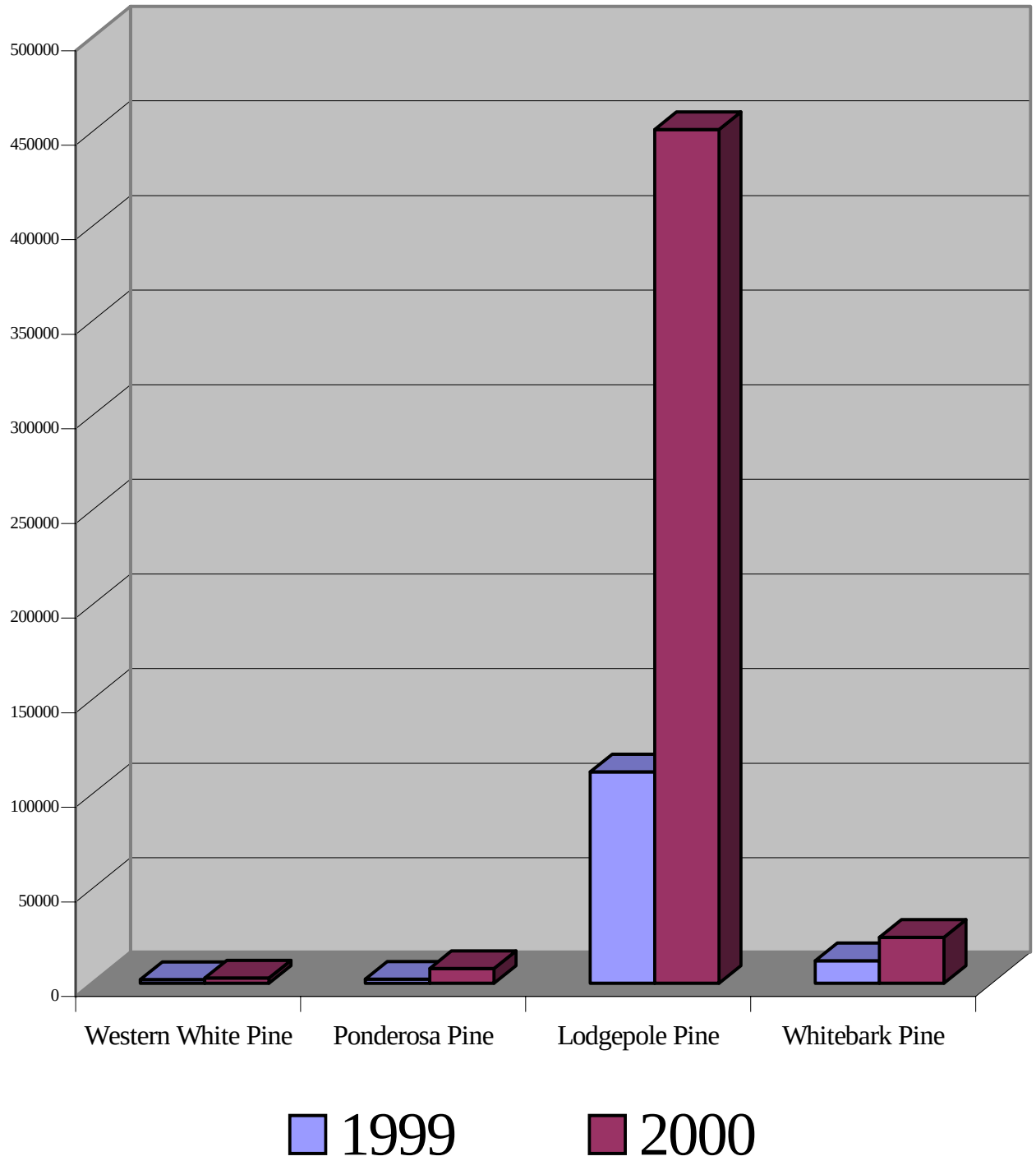

Figure 1. Mountain Pine Beetle Mortality
by Host Species as determined by
Aerial Surveys in Idaho 1999 – 2000

PINE ENGRAVER\WESTERN PINE BEETLE

1999 - The most significant pine engraver activity noted in the 1999 aerial survey (1998 attacks) occurred on State and Private Lands on the Coeur d'Alene, and the Kaniksu Reporting areas in the Idaho Panhandle with sixty seven per cent of all pine engraver, 5,600 killed trees, on 1,200 acres. In the Coeur d'Alene reporting area pine engraver was the credited mortality agent for 1,247 ponderosa pines across 768 acres. Pine engraver activity in lodgepole pine was also highest in the Coeur d'Alene reporting area with 4,625 dead trees mapped across 1,069 acres and the Kaniksu reporting area with 1,005 dead trees mapped across 165 acres, with a State total of just over 8,700 trees killed on 2533 acres (Table 2, Figure 2). There was no obvious trigger for the increased pine engraver mortality mapped in 1999 in northern Idaho. Above average precipitation during the winter 1998-99 throughout typically dry and often susceptible ponderosa pine stands in western Montana and northern Idaho, should result in a reduction of engraver beetle caused damage detected in the 2000 aerial survey. These mortality levels are considered endemic. Land managers are becoming increasingly aware of the need for proper slash management during late winter and early spring logging in ponderosa pine stands which should help reduce losses to engraver beetles. Activity is often associated with western pine beetle.

1999 - Tree mortality attributed to western pine beetle declined to 6,719 trees on 5,872 acres (Table 2, Figure 2) State wide. This is down from nearly 18,000 acres in 1998. The only concentrations of western pine beetle killed trees were located in northern Idaho with just under 5,000 trees recorded on state and private lands, on 2,952 acres. Elsewhere in the State mortality was widely scattered in fairly small groups throughout the ponderosa pine type.

2000 - Most pine engraver beetle activity in the State in 2000 was recorded in ponderosa pine stands on State and private lands in the Idaho Panhandle reporting areas (Table 2, Figure 2). Total mortality in 1999 was estimated at just over 8,700 ponderosa and lodgepole pines killed on nearly 2,500 acres (Table 2). Although estimated mortality decreased in 2000 (trees killed in 1999) to only 1,000 killed trees, both in ponderosa and lodgepole stands, there is a possibility of increasing mortality in 2001 because of unusually warm and dry weather during summer 2000, and the number of fire-affected ponderosa pine stands. For 2000, pine engraver beetle-caused mortality was estimated at 1,000 ponderosa pines on approximately 600 acres (Table 2, Figure 2), about half were on State and private lands on the Idaho Panhandle and Kaniksu NFs reporting area and with 400 killed trees on the Boise NF reporting area.

2000 - Ponderosa pine mortality, attributed to western pine beetle, declined once again. In 2000, just over 1,700 beetle-killed trees were recorded on 1,346 acres (Table 2, Figure 2)—down from approximately 6,700 trees on 5,872 acres (Table 2, Figure 2) in 1999. Most mortality—on more than 1,300 acres (Table 2)—was observed in northern Idaho. Elsewhere in the State, western pine beetle-caused mortality was light and quite scattered. There is a potential for western pine beetle populations to increase in 2001. Large amounts of fire-weakened ponderosa pines, resulting from widespread fires in 2000 and drier-than-normal conditions, have created conditions conducive to beetle population survival and expansion. Very little mortality due to western pine beetle was recorded in 2000 in Southern Idaho.

SPRUCE BEETLE

1999 - Spruce beetle populations remained low throughout the State in 1999 with a total of only 302 killed trees (Table 2, Figure 2) on just over 200 acres State wide, but making small advances in north Idaho. Most of this mortality occurred as small and scattered groups of beetle-killed Engelmann spruce on the Idaho Panhandle (St. Joe and Kaniksu) reporting areas and just 100 Engelmann spruce killed trees on the Payette reporting area. No significant mortality was observed in any other area of southern Idaho reporting areas.

2000 - Spruce beetle populations once again remained low throughout the State in 2000, with infested area increasing slightly statewide, over 1999 levels. In northern Idaho there were 320 trees killed on just over 250 acres (Table 2, Figure 2) were recorded. Most occurred as small and scattered groups on the Idaho Panhandle, Nez Perce, and Clearwater reporting areas. In southern Idaho there were a total of just over 2,000 trees killed over 800 acres (Table 2, Figure 2) with 700 of those killed trees on the Targhee reporting area and another 500 killed trees on the Payette reporting area. For a total of just over 2,400 trees killed on just over 1,000 acres statewide. No significant mortality was observed in any other Idaho reporting areas.

Table 2. Idaho Statewide summary; annual bark beetle mortality by reporting area.

		Pine Engraver Beetle Estimated Mortality (PP&LPP)			**Western Pine Beetle** Estimated Mortality			**Spruce Beetle** Estimated Mortality		
AREA	Year	Acres Infested	Trees	MBF Volume	Acres Infested	Trees	MBF Volume	Acres Infested	Trees	MBF Volume
Bitterroot	2000	0	0	0.0	0	0	0.0	0	0	0.0
	1999	0	0	0.0	18	10	4.0	21	29	11.6
Boise	2000	400	400	4.0	0	0	0.0	100	300	143.4
	1999	100	200	2.0	0	0	0.0	0	0	0.0
Caribou	2000	0	0	0.0	0	0	0.0	100	100	47.8
	1999	0	0	0.0	0	0	0.0	0	0	0.0
Clearwater	2000	0	0	0.0	6	20	8.0	4	2	0.8
	1999	2	5	0.1	24	72	28.8	2	3	1.2
Coeur d'Alene	2000	2	10	0.3	128	146	58.4	106	110	44.0
	1999	0	0	0.0	582	593	237.2	6	12	4.8
Kaniksu	2000	0	0	0.0	369	250	100.0	50	90	36.0
	1999	2	5	0.1	1,689	515	206.0	42	83	33.2
Kootenai	2000	0	0	0.0	36	21	8.4	4	5	2.0
	1999	0	0	0.0	0	0	0.0	0	0	0.0
Nez Perce	2000	24	170	4.3	22	36	14.4	65	60	24.0
	1999	0	0	0.0	119	140	56.0	0	0	0.0
Payette	2000	0	0	0.0	0	0	0.0	200	500	239.0
	1999	0	0	0.0	0	0	0.0	50	100	47.8
Salmon- Challis	2000	0	0	0.0	45	25	13.8	60	301	143.9
	1999	0	0	0.0	0	0	0.0	0	0	0.0
Sawtooth	2000	0	0	0.0	0	0	0.0	100	100	47.8
	1999	0	0	0.0	0	0	0.0	0	0	0.0
St. Joe	2000	0	0	0.0	169	100	40.0	6	15	6.0
	1999	2	5	0.1	310	70	28.0	68	40	16.0
Targhee	2000	0	0	0.0	0	0	0.0	200	700	334.6
	1999	0	0	0.0	0	0	0.0	0	0	0.0
Indian Res.	2000	0	0	0.0	35	62	24.8	0	0	0.0
	1999	91	382	8.4	105	213	85.2	0	0	0.0
BLM	2000	0	0	0.0	14	26	10.4	0	0	0.0
	1999	0	0	0.0	73	120	48.0	2	5	2.0
Other Lands	2000	163	422	10.5	522	1,038	429.3	55	118	52.7
	1999	2,336	8,171	173.6	2,952	4,986	1994.4	10	30	12.0
Idaho Totals	2000	589	1,002	19.0	1,346	1,724	707.5	1,050	2,401	1,121.9
	1999	2,533	8,768	184.4	5,872	6,719	2,687.6	201	302	128.6

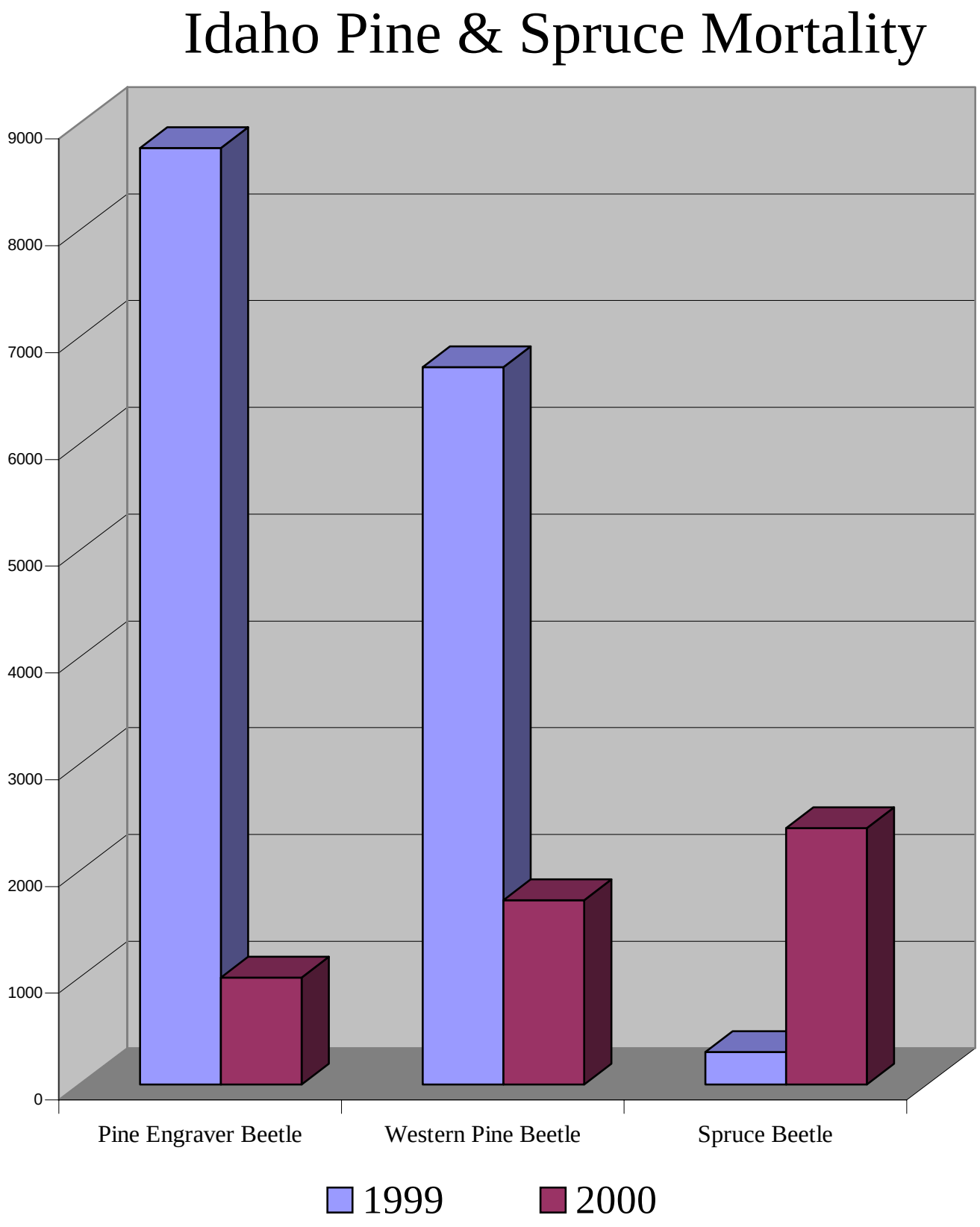

Figure 2. Pine and Spruce Mortality by Bark Beetle Species as determined by Aerial Surveys in Idaho1999--2000

DOUGLAS-FIR BEETLE

1999 - As expected, Douglas-fir beetle caused tree mortality increased dramatically in 1999 to nearly 400,000 killed trees (Table 3, Figure 3) statewide. These trees were actually attacked by the beetle in 1998, but most crowns didn't fade until 1999. Statewide infested acres increased from about 47,000 in 1998 to over 163,500 acres in 1999. Most of the increase occurred on the Coeur d'Alene reporting area, with 131,300 killed trees (Table 3, Figure 3) on 63,600 acres and on the Bitterroot reporting area, with another 52,000 killed trees (Table 3, Figure 3) on 20,000 acres, and adjacent lands. This is the highest level of tree mortality caused by Douglas-fir beetles in the State since the early 1950's. This outbreak was linked to unusually high amounts of wind-thrown and winter damaged trees available to the beetles in the spring of 1997. Most of this material on National Forest was not salvaged and provided ideal conditions for a Douglas-fir beetle population build-up. Ground surveys conducted in the fall of 1999 indicate that 1998 (detected by 1999 aerial survey) was probably the peak of the outbreak. Other than a few areas with still building populations, we anticipate an overall declining trend for the next few years.

2000 – The Douglas-fir Beetle estimated mortality for 2000 was 393,800 killed trees on 171,300 acres (Table 3, Figure 3). Extreme fire conditions in western Montana in 2000 prevented completion of aerial detection surveys over significant areas of known infestation (notably the Bitterroot NF). While beetle damage estimates for 2000 may be incomplete; we believe that, State-wide, Douglas-fir beetle populations have increased from 1999 when an estimated 400,000 trees had been killed (Table 3) on more than 163,500 acres. In 2000, the infested area had increased to just over 171,300 acres (Table 3), even without the Bitterroot numbers. The largest outbreak was on the Coeur d'Alene, 105,200 trees killed and Kaniksu NF, 63,800 killed trees, reporting areas. In 1999, 56,100 trees were killed on 12,500 acres (Table 3) in the Idaho portion of the Bitterroot reporting area. While Douglas-fir beetle populations were remaining about the same as last year in most areas, the fires of 2000 could reverse that trend. A vast amount of fire-weakened Douglas-fir, may prove to be the source of resurging Douglas-fir beetle populations within the next 2-3 years. Outbreaks were located on all the reporting areas of southern Idaho, with the largest amount of beetle-killed trees recorded on the Payette reporting area, 16,100 killed trees (Table 3) and on the Boise reporting area, 9,100 killed trees (Table 3).

FIR ENGRAVER

1999 - Fir engraver caused mortality continued to decline in 1999 after reaching a high in 1997. An estimated 10,350 trees Statewide were killed on 9,300 acres (Table 3, Figure 3) according to the 1999 aerial survey (1998 beetle activity). Fir engraver caused mortality was most evident in northern Idaho where on the Coeur d'Alene NF reporting area (Coeur d'Alene River Ranger District of the Idaho Panhandle National Forest and adjacent lands) 2,900 dying trees were mapped on over 4,100 acres (Table 3, Figure 3). The St. Joe reporting area, just south of the Coeur d'Alene reporting area, had over 1,300 dying trees on about 1,800 acres (Table 3). The Nez Perce reporting area, just north of the Salmon River in Idaho, had approximately 1,200 dying trees mapped on 1,100 acres (Table 3). All other reporting areas had far fewer acres and trees affected. No significant fir engraver caused mortality was reported in southern Idaho.

2000 - Fir engraver caused mortality in grand fir stands continued at low, nearly endemic levels, in northern Idaho in 2000. In 1999, an estimated 10,350 trees were killed on 9,300 acres statewide (Table 3, Figure 3), most on the Idaho Panhandle NFs and to a lesser extent on the Nez Perce NF. In 2000, those figures were just under 2,900 beetle-killed trees on about 2,400 acres state-wide (Table 3, Figure 3), most of which were recorded on State and private lands in northern Idaho. Only minor amounts were observed on other reporting areas in northern Idaho. Once again no significant fir engraver was observed in any reporting area of southern Idaho.

WESTERN BALSAM BARK BEETLE/ SUBALPINE FIR COMPLEX

1999 - the area of subalpine fir "decline" increased in Idaho, state-wide. Several agents, notably root diseases and secondary bark beetles, are often found to be involved in the complex of pests causing this decline. Western balsam bark beetle *(Dryocoetes confusus)* appears to be the most commonly observed organism in the "complex". Over 35,200 subalpine fir were killed trees on almost 43,000 acres (Table 3, Figure 3) in 1999, compared to 13,500 killed trees on 16,000 acres in 1998. While the number of killed trees and infested acres increased, in at least some areas of southern Idaho, the intensity of tree killing appeared to decline. In all areas of northern Idaho, the number of killed trees has increased. Of the infested area recorded, approximately 37,100 acres (Table 3) were in northern Idaho, principally on the Idaho Panhandle and Nez Perce NFs. State-wide an estimated 35,200 subalpine fir were killed (Table 3, Figure 3) in 1998 and recorded as faders in 1999. Ground examinations suggest a complex of factors are involved in this mortality. These factors include: twig beetles, secondary bark beetles, wood borers, fir engraver beetles, root diseases, cankers, rusts, and environmental conditions. In southern Idaho, 1,100 trees were killed (Table 3) on the Caribou National Forest.

2000 - WBBB/SAF complex populations continue to increase in 2000. Many **a**reas in which subalpine fir mortality (not attributed to balsam woolly adelgid) was observed remained high in 2000. Because of fire-related adjustments to aerial detection surveys, many areas containing epidemic levels of mortality in recent years were not flown in 2000. Direct comparisons of infested areas from 1999 to 2000 were, therefore, not feasible. Had all areas known to harbor western balsam bark beetle populations been flown, the infested area likely would have exceeded that recorded in 1999. Much of the mortality occurring on these high-elevation sites results from varying combinations of root diseases, bark beetles, and perhaps other factors such as climatic change. The most significant single factor, however, is thought to be mortality directly or indirectly caused by western balsam bark beetle (*Dryocoetes confusus*). In 1999, more than 42,800 acres (Table 3) showed some level of mortality—generally 1-2 trees per acre. On most areas, western balsam bark beetle was regarded as the primary causal agent. In 2000, an estimated 58,600 dying subalpine fir were recorded on more than 52,700 acres (Table 3, Figure 3). Forested areas most affected were the Kaniksu reporting area, 14,600 trees killed (Table 3) on the Idaho Panhandle and Nez Perce reporting area, 16,700 trees killed (Table 3) and on the Targhee reporting area, 5,000 trees killed, the Salmon-Challis reporting area, 3,600 trees killed and the Caribou reporting area, 2,200 trees killed, (Table 3).

Table 3 Idaho Statewide summary; annual bark beetle mortality by reporting area.

		Douglas-fir Beetle Estimated Mortality			**Fir Engraver** Estimated Mortality			**Western Balsam Bark Beetle** Estimated Mortality			**Subalpine fir Complex** Estimated Mortality		
AREA	Year	Acres Infested	Trees	MBF Volume	Acres Infested	Trees	MBF Volume	Acres Infested	Trees	MBF Volume	Acres Infested	Trees	MBF Volume
Bitterroot	2000	0	0	0.0	0	0	0.0	0	0	0			
	1999	12,469	56,121	19,642.4	0	0	0.0	48	86	9.5			
Boise	2000	9,000	15,900	2,257.8	0	0	0.0				0	0	0.0
	1999	5,700	9,100	1,292.2	0	0	0.0				0	0	0.0
Caribou	2000	1,000	2,200	312.4	0	0	0.0				700	2,200	242.0
	1999	400	50	7.1	0	0	0.0				1,000	1,100	121.0
Clearwater	2000	11,334	29,981	10,493.4	86	124	24.8	879	2,081	228.9			
	1999	9,031	25,950	9,082.5	58	85	17.0	575	1,848	203.3			
Coeur d'Alene	2000	62,329	105,267	36,843.5	552	520	104.0	2,211	4,006	440.7			
	1999	63,673	131,328	45,964.8	4,121	2,894	578.8	956	1,167	128.4			
Kaniksu	2000	27,915	63,830	22,340.5	56	50	10.0	16,340	14,683	1,615.1			
	1999	19,875	51,950	18,182.5	18	73	14.6	8,822	7,668	843.5			
Kootenai	2000	13,974	37,465	13,112.8	6	6	1.2	1,956	2,058	226.4			
	1999	255	365	127.8	0	0	0.0	14	31	3.4			
Nez Perce	2000	15,643	57,063	19,972.1	148	85	17.0	18,094	16,729	1,840.2			
	1999	14,075	39,991	13,996.9	1,105	1,176	235.2	16,667	12,470	1,371.7			
Payette	2000	3,800	8,700	1,235.4	0	0	0.0				100	400	44.0
	1999	12,500	16,100	2,286.2	0	0	0.0				0	0	0.0
Salmon-Challis	2000	500	1,700	241.4	0	0	0.0				800	3,600	396.0
	1999	1,000	1,000	142.0	0	0	0.0				0	0	0.0
Sawtooth	2000	3,400	5,400	766.8	0	0	0.0				200	800	88.0
	1999	900	1,600	227.2	0	0	0.0				400	400	44.0
St. Joe	2000	5,072	11,483	4,019.1	49	60	12.0	6,228	2,769	304.6			
	1999	4,579	16,010	5,603.5	1,833	1,305	261.0	8,523	5,606	616.7			
Targhee	2000	2,600	7,700	1,093.4	0	0	0.0				900	5,000	550.0
	1990	300	800	113.6	0	0	0.0				0	0	0.0
Indian Res.	2000	101	190	66.5	2	2	0.4	0	0	0.0	0	0	0.0
	1999	1,340	2,645	490.7	8	30	6.0	0	0	0.0	290	410	45.1
BLM	2000	3,178	8,045	2,441.4	2	5	1.0	1,767	635	69.9	300	400	44.0
	1999	2,380	6,539	2,237.7	26	91	18.2	408	471	51.8	294	511	56.2
Other Lands	2000	11,426	38,892	13,362.6	1,511	2,008	401.6	1,058	1,933	212.6	1,200	1,300	143.0
	1999	718	945	132.3	5	7	1.3	1,069	957	105.3	3,766	2,512	276.3
Idaho Totals	2000	171,372	393,816	128,558.8	2,412	2,860	572.0	48,533	44,894	4,938.4	4,200	13,700	1,507.0
	1999	163,549	398,641	132,889.0	9,269	10,350	2,070.0	37,082	30,304	3,333.6	5,750	4,933	542.6

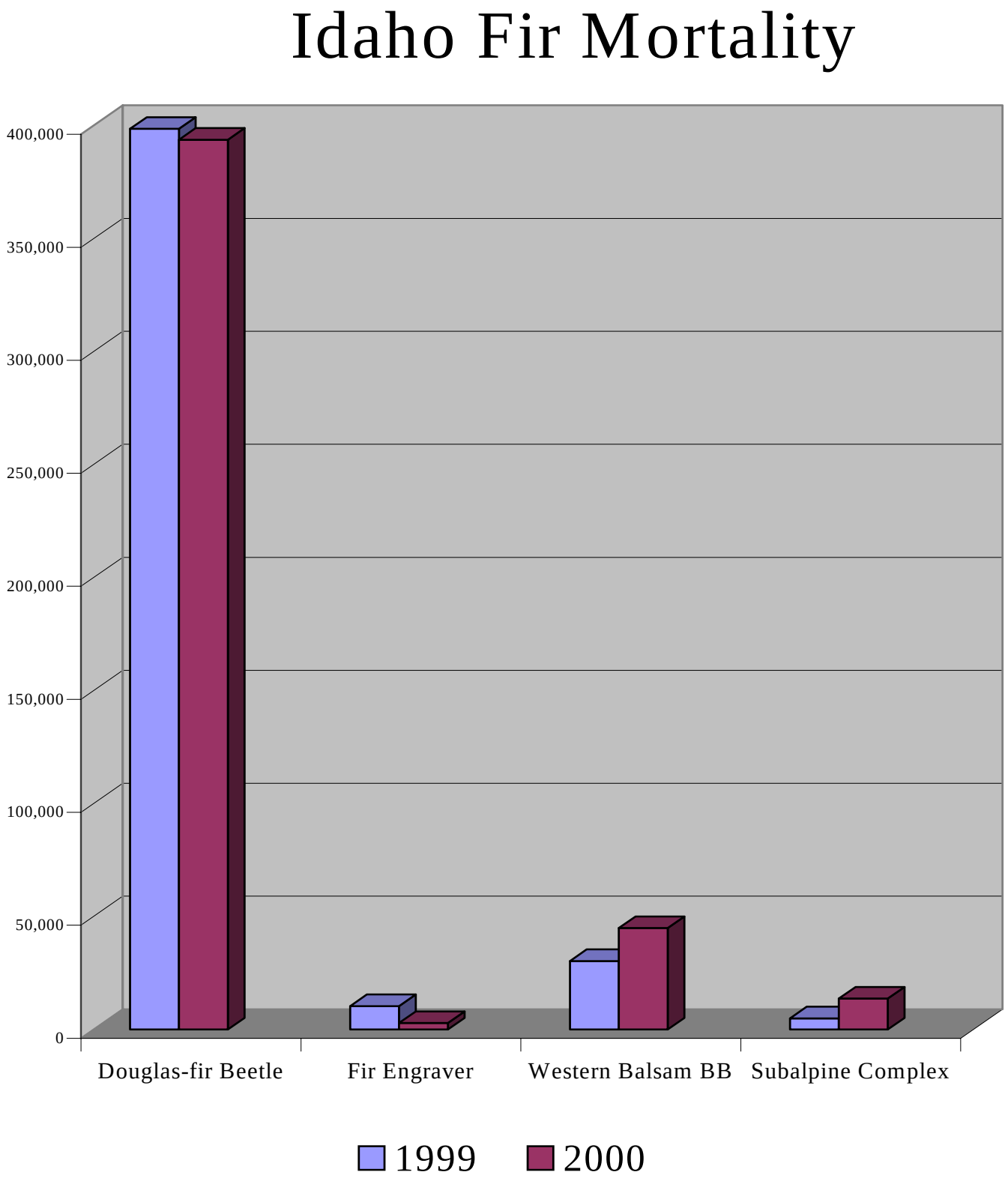

Figure 3. Fir Mortality
by Bark Beetle Species as determined
by Aerial Surveys in Idaho 1999 - 2000

DEFOLIATORS

DOUGLAS-FIR TUSSOCK MOTH

1999 – No aerially visible defoliation was detected in northern Idaho. However, trap catches of Douglas-fir tussock moth suggest that populations may have doubled in 1999 and larvae were found at most sites sampled. At approximately 95 trapping sites in northern Idaho, about 12,000 moths were caught in 1999, compared to 6,500 moths in 1998. Some minor defoliation was observed on ornamental trees in residential areas, but none was noted in forest stands. Trap catches, some larval sampling and observations suggest populations should continue to increase, and defoliation is expected in northern Idaho in 2000. This trend may be part of a larger population outbreak pattern/cycle that is occurring in other parts of the northwest. Approximately 17,000 acres of defoliation from Douglas-fir tussock moth were observed in the Owyhee Mountains in southwestern Idaho. Pheromone baited trap catches indicated increasing populations on the Weiser and Council Ranger Districts of the Payette National Forest.

DOUGLAS-FIR TUSSOCK MOTH

2000 – In the spring of 2000 lower crown sampling found sub-outbreak levels at most of the thirty-four sites sampled. Pheromone trapping took place at 94 sites, 10 sites in the Coeur d'Alene Mtn. area and 84 sites in the Plummer-Moscow area. Douglas-fir tussock moths were caught in all eighty-four Plummer-Moscow sites. The highest average at any site was 112.0 moths per trap. Seventy five of the eighty four sites had more than twenty-five Douglas-fir tussock moths per trap, with a mean average of 70.4 at all trap sites. Just over 37,600 moths were caught in 2000. Several sites had cocoons and egg masses in the cryptic shelters. Douglas-fir tussock moth populations reached outbreak proportions in parts of northern Idaho, where the fall aerial survey results reported 54,753 acres defoliated near the town of Potlatch, Idaho on the Palouse Ranger District of the Clearwater National Forest and adjacent state, private, and reservation lands. Additional defoliation is anticipated in northern Idaho in 2001, and the Idaho Department of Lands is evaluating control options on state and private lands. Defoliation was severe on Bureau of Land Management, State of Idaho, and private Douglas-fir forests in the Owyhee Mountains of southwestern Idaho. Pheromone baited trap catches were in the high category on the Weiser and Council Ranger Districts of the Payette National Forest in central Idaho.

LARCH CASEBEARER

1999 - visible defoliation caused by larch casebearer increased significantly in many western larch stands throughout northern Idaho. Though a few areas in which defoliation had been recorded in 1998 decreased in intensity; in other areas, defoliation was recorded for the first time. Defoliation heavy enough to be detected during aerial surveys, was found in several areas. In others areas, increasing defoliation was noted through ground observations. In total, more than 14,000 acres showed some level of observable defoliation in 1999. Most noticeably affected areas were on the Kaniksu NF in northern Idaho (5,600 acres). Surveys conducted during 1997, 1998 and 1999 showed low parasitism rates in casebearer populations, compared to similar surveys conducted during the 1970s, the last time populations were unusually high. Parasitism levels generally less than 15-20% in the past three years compared with rates of 40-65%--rates common in the early 1980s when casebearer populations began to decline. Surveys indicated that some areas will again experience moderate to heavy defoliation in 2000. Monitoring of population levels and parasitism rates will continue.

LARCH CASEBEARER

2000 - visible defoliation caused by larch casebearer decreased significantly from 1999 in many western larch stands throughout northern Idaho. Increases evident in 1999, when approximately 14,000 acres showed some level of defoliation, did not continue in 2000. Only a few areas exhibited current or new defoliation in 2000; most areas defoliated in 1999 showed little or no casebearer activity in 2000. Most noticeably affected areas remained on the Idaho Panhandle NFs in northern Idaho where slightly more than 400 acres of defoliation were recorded. Ground surveys made from 1997 through 2000 continued to show low parasitism rates in most casebearer populations, at least when compared to similar surveys conducted during the 1970s, the last time populations were unusually high. Current parasitism levels do not seem high enough to totally account for population declines, but other causes have not been determined. Surveys indicated that few areas will experience noticeable defoliation in 2001. Casebearer populations are sufficiently high in only a few areas to warrant continued population monitoring.

WESTERN SPRUCE BUDWORM

1999 - Defoliation from western spruce budworm on permanent plots remained the same on forests in Idaho. Pheromone trap counts were up significantly in some areas in 1999, but remained the same or decreased in others. In Idaho, approximately 2,500 acres of mostly light defoliation were mapped on the Targhee National Forest. This is the first western spruce budworm defoliation observed since 1987 in Idaho.

WESTERN SPRUCE BUDWORM

2000 - Western spruce budworm defoliation was observed last year on the Dubois Ranger District of the Targhee National Forest. This was the first re-occurrence of the insect in Idaho since 1987 when the epidemic population crashed following a July late-frost. In 2000, almost 5,000-acres were defoliated in total on the Boise, Payette, Sawtooth, and Targhee National Forests. As compared to the peak years of the mid 80's were defoliation reached almost 3 million acres.

Douglas-Fir Tussock Moth

Table 4 Means of average moth catch per 5 pheromone trap/sample plots in Idaho, **2000-1990**

AREA	Number of 2000 sample plots	2000	1999	1998	1997	1996	1995	1994	1993	1992	1991	1990
STATE AND PRIVATE												
Coeur d'Alene	5	0.0	0.6	0.3	0.08	0.0	0.0	0.0	0.0	0.1	0.0	*
Coeur d'Alene	5	0.0	0.5	0.08	0.0	0.0	0.0	0.0	0.0	0.1	0.1	7.2
Plummer-Moscow	14	75.7	37.8	21.4	3.9	0.3	0.3	0.0	0.0	0.7	0.1	0.1
Plummer-Moscow	19	64.7	25.8	14.0	1.3	0.08	0.04	0.1	0.0	0.5	0.1	0.1
Plummer-Moscow	6	55.9	19.0	2.6	0.1	0.0	0.0	0.0	0.0	0.5	0.0	0.1
Plummer-Moscow	2	97.4	51.3	46.3	3.4	0.1	0.2	0.0	0.0	4.0	0.0	0.0
Plummer-Moscow	4	92.1	55.8	50.8	2.4	0.2	0.1	0.0	0.0	0.2	0.0	0.0
Plummer-Moscow	3	96.1	55.6	29.7	2.2	0.3	0.07	0.0	0.0	1.6	0.1	0.1
Plummer-Moscow	13	82.4	69.7	30.1	7.9	1.4	0.01	0.0	0.0	0.1	0.1	0.2
Plummer-Moscow	23	59.3										
Craig Mountain	8	0.0	0.6	0.5	0.0	0.0	0.0	0.0	0.05	0.5	0.0	0.2
NEZ PERCE NF												
Moose Ck RD	5	1.0	2.4	1.7	0.0	0.0	0.0	0.0	0.04	0.1	0.0	0.4
Salmon River RD	6	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.08	0.7	2.5	0.1
CLEARWATER NF												
Lochsa RD	1	*	0.0	0.4	0.0	0.0	0.0	0.0	0.0	0.2	1.2	0.0
North Fork RD	10	0.8	1.9	2.6	0.0	0.0	0.0	0.0	0.0	0.1	0.3	0.2
Pierce RD	1	1.0	0.4	0.3	0.0	0.0	0.0	0.0	0.0	0.3	0.6	0.3
BOISE NF												
Mountain Home RD	8	15.4	3.8	0.1	0.5	2.1	0.0	0.1	0.0	32.2	68.9	5.3
Idaho City RD	9	0.8	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.6	27.2	*
Cascade RD	5	0.2	0.2	0.04	0.0	0.0	0.0	0.0	0.0	0.4	0.7	31.6
Lowman RD	9	0.4	0.0	0.1	0.0	0.0	0.0	0.0	0.0	1.8	20.0	*
Emmett RD	10	6.9	6.8	3.0	0.3	0.02	0.0	0.0	0.02	1.2	19.7	*
PAYETTE NF												
Council RD	12	15.8	13.1	5.8	1.4	0.05	0.1	0.0	0.0	2.8	6.6	23.2
Weiser RD	12	19.0	29.9	26.9	3.6	0.6	0.1	0.1	0.0	2.4	21.4	67.0
New Meadows RD	10	9.8	9.3	5.3	0.6	0.02	0.0	0.0	0.0	1.6	8.8	*
McCall RD	6	2.7	1.7	0.6	0.0	0.0	0.0	0.0	0.0	0.8	0.7	*
SAWTOOTH NF												
Fairfield RD	5	9.0	1.7	0.5	0.08	0.1	0.0	0.3	0.0	35.3	70.5	35.3
OTHER												
Owyhee Mountains	3	84.6	40.2	32.1	30.6	24.0	13.1	2.0	0.0	51.1	76.1	51.1
Sharps Canyon	1	29.6	12.8	*	0.4	0.0	0.0	0.0	0.0	18.8	*	18.8

Douglas-Fir Tussock Moth
Pheromone Trap Catches

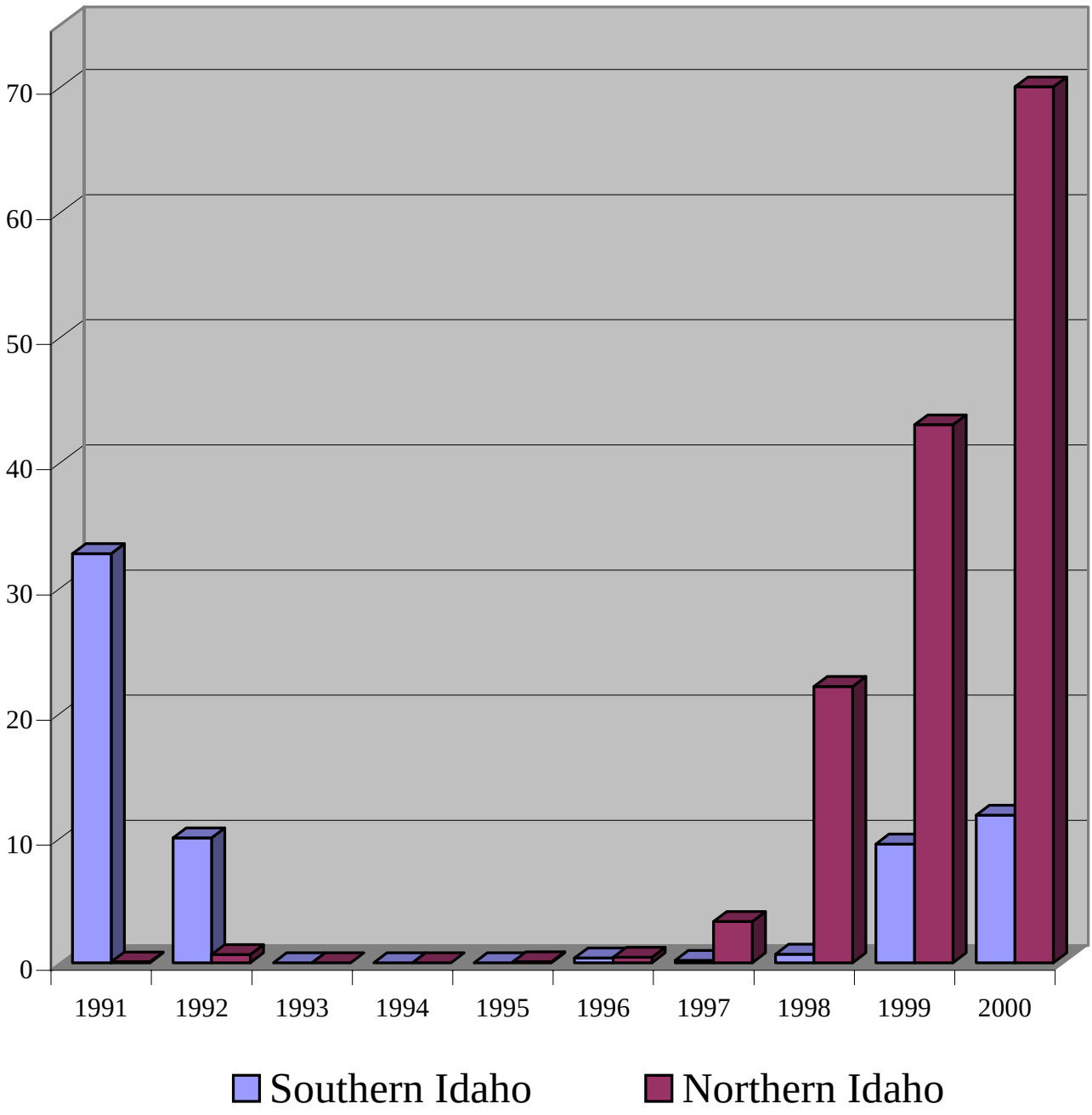

Figure 4 USFS and IDL
Douglas-fir Tussock Moth Trap Catches
in Idaho 1991 - 2000

GYPSY MOTH

The Idaho gypsy moth detection survey program systematically samples all populated areas of the State in order to detect introductions of gypsy moths. Many USDA Forest Service campgrounds are sampled, as well as rest stops, tourist attraction sites and other locations where people congregate. High risk areas, those cities with the highest populations and the highest potential for newly arriving families, are trapped each year. Other areas are trapped every other year or every third year. The survey will continue to expand as cities grow and more people move into the rural areas of our state. All trapping results are incorporated into the National Agricultural Pest Information System (NAPIS) database.

DETECTION TRAPPING

In 1999 the cooperating agencies in the Idaho gypsy moth detection program placed 4,837 detection traps throughout the state. Another 5,398 detection traps were deployed statewide in 2000. Pheromone-baited traps were placed on a grid basis at a density of four traps per square mile. Traps were placed throughout the state in cities and towns and the surrounding urban areas and rural communities in accordance with a predetermined rotation schedule. Cities and communities where 20 or more move-ins occur are trapped irrespective of their place in the schedule. A move-in is defined as an individual or family moving to Idaho from a state that is generally infested with gypsy moths. This information is derived from vehicle registration information supplied by the Idaho Department of Transportation. Most infestations are initiated when an egg mass or other life stage of the gypsy moth arrives on an outdoor household article brought by someone moving into the area. Between May 1998 and April 1999, 4,989 “move-ins” occurred, representing a 1.5% increase over the previous year. Between May 1999 and April 2000, there were 5,070 “move-ins” to the state, representing a 1.6% increase over the previous year. Campgrounds, tourist attractions, and other high-risk locations were also trapped.

DELIMITATION TRAPPING

Delimitation traps were placed at 2 locations in 1999. In 2000 delimitation traps were placed at only 1 location. At Huetter, between Coeur d’Alene and Post Falls in Kootenai County 141 traps in 1999 and 36 traps in 2000 were placed in the 4 square miles surrounding the site where 5 gypsy moths were caught in 1998. An eradication treatment was applied to the site in the spring of 1999. No moths were caught at the site during the summer trapping in 1999. Since this is the second trapping season with no moths caught, this introduced population is now officially declared eradicated. At Weitas Campground in Clearwater County 14 delimitation traps were placed in the area where a single gypsy moth was caught in 1998. Due to the lack of significant contiguous host trees no delimitation traps were placed at Arco in Butte County where a single moth was caught in 1998. Instead the Arco area was trapped at the regular detection density again in 1999 and was not trapped in 2000.

MASS TRAPPING

In 1999 the 10 acres immediately surrounding the catch site at Huetter were trapped at a density of 9 traps per acre. No mass trapping was done in Idaho in 2000.

No gypsy moths were caught in Idaho in 1999 or 2000.

STATE ADVISORY COMMITTEE

An advisory committee, composed of representatives from the Idaho Department of Lands, The Idaho Department of Agriculture, The U. S. Forest Service Regions 1 and 4, and APHIS, reviews activities and provides guidelines for the gypsy moth program in Idaho.

Figure 5. State of Idaho
1999-2000 Gypsy Moth Catch Sites

OTHER INSECTS

Balsam Woolly Adelgid

1999 - Aerial survey data estimated nearly 96,070 acres infested by the balsam woolly adelgid in 1999, a significant increase from the 53,400 acres infested in 1998. Actual infested acres is higher as some infested areas are not yet displaying crown symptoms. Areas with the heaviest infestations occur on the Idaho Panhandle, Clearwater, and Nez Perce NFs and adjacent State, private, and BLM land. Subalpine fir of all ages and size classes are killed. Extensive gouting and bole infestations occur on grand fir, but only regeneration in the grand fir type has suffered mortality. Regeneration mortality of both subalpine and grand fir is high, resulting in forest type conversions in some areas. Surveys to help delimit the distribution and assess damage caused by balsam woolly adelgid were begun in 1998. Additional damage assessment surveys were conducted in 1999 and results of this work should be available in the form of a distribution survey to be published in the Western Journal of Applied Forestry. In a few low elevation sites, where adelgid populations became established in the early 1980s, subalpine fir has virtually been eliminated.

2000 - Aerial survey data estimate 56,426 acres infested by the balsam woolly adelgid in 2000. Actual infested acres are probably higher with some areas not yet displaying crown symptoms. Areas with the heaviest infestations occur on the St Joe, Clearwater, and Nez Perce NFs and adjacent state, private, and BLM lands. Subalpine fir of all ages and size classes are killed. Extensive gouting and bole infestations occur on grand fir, but to date no grand fir over 5 inches in diameter has been documented as being killed by the adelgid. Regeneration mortality of both subalpine and grand fir is high, resulting in forest type conversions in some areas. Continued surveys to delimit the distribution of the balsam wooly adelgid and damage assessment surveys are planned in the near future.

Cooley Spruce Gall Adelgid

1999 - This adelgid was found in forested stands and ornamental trees throughout the Region; impact is greatest on ornamental spruce trees. On Douglas-fir, the alternate host, infested needles often develop a yellow spot and twist at the point of attack.

Fall cankerworm

1999 - In southeastern Idaho, approximately 2,000 acres of maple defoliation were reported and attributed to the fall cankerworm.

Pine Sawflies

1999 - Defoliation of ponderosa pine caused by a sawfly was detected on 500 acres of private land near Lakefork, Idaho.

CONE AND SEED INSECTS

Western conifer seed bug, Coneworm, Cone beetle

1999 – 2000 Cone and seed insects can cause considerable damage to the seeds of western conifers, significantly reducing seed crops. Though insects are found feeding on a variety of tree species in wild stands, they are especially of concern in blister rust-resistant western white pine seed orchards. Seed collected in these orchards is used to regenerate areas where white pine, once the dominant tree species, has nearly disappeared due to white pine blister rust. The insects that cause the most damage in western white pine are western conifer seed bug, *Leptoglossus occidentalis*, cone beetle, *Conophthorus ponderosae*, and coneworm, *Dioryctria abietivorella*. One or more of these insects are often so abundant in northern Idaho white pine seed orchards to warrant an insecticidal spray treatment to protect cones. These insects have also been found destroying whitebark pine seed in high elevation stands. Whitebark pine is an important tree species for watersheds, wildlife, recreation, and aesthetics. This tree species has significantly declined in recent years due to blister rust, periodic outbreaks of mountain pine beetle, natural forest succession and fire suppression. Its seed is extremely valuable for wildlife and regeneration and may need to be protected from insect predation in the future. Studies are underway in cooperation with Forest Insect and Disease research to develop cone beetle behavior chemicals for monitoring and control tools for integrated pest management programs.

FOREST DISEASES

STEM AND BRANCH DISEASES

Comandra blister rust

This disease occurs infrequently on lodgepole and ponderosa pine throughout Idaho. Localized areas of heavy infection resulting in branch, top, and entire tree mortality of sapling-size ponderosa pine occurs in offsite plantations in southern Idaho.

Dutch elm disease

In Idaho this disease is common in many communities along the Snake River in southern Idaho, and is slowly working its way into northern Idaho communities. It was discovered in Moscow in 1990, but an aggressive treatment program has limited losses to only a few trees per year for the past several years. It has also been discovered in several communities nearby--Genesee, in Idaho; Palouse and Pullman, in Washington.

Pinyon blister rust

This disease occurs on pinyon pine in the Raft River Mountains on the Sawtooth National Forest in central Idaho. Disease levels are generally sporadic and tree mortality is low.

Stalactiform rust

This rust disease occurs on lodgepole pine in localized areas throughout Idaho. Severe infection has occurred in localized areas on the Boise, Payette, Sawtooth and Targhee National Forests.

Western gall rust

This disease occurs throughout the range of lodgepole and ponderosa pine in Idaho. Disease levels vary from year to year; some sites are more prone to damage from this disease than others. Individual tree resistance to this disease is common; in some locations where most trees are infected, individuals may not display disease symptoms. Generally the disease is not an important cause of mortality, although branch and stem breakage can be of concern, especially within recreation areas. Gall rust is an important consideration in tree improvement plantations where infection can significantly affect performance of young trees.

White pine blister rust

White pine blister rust was introduced into western North America about 1910, and subsequently spread to western white pine, whitebark pine and limber pine in Idaho and other western forests. This disease along with bark beetles, fire suppression, and logging resulted in reducing white pine dominated stands to less than 5% of the 5 million acres where it once was the dominant species. This disease continues to kill seedlings that naturally regenerate from remaining white pine trees, and, in collaboration with mountain pine beetle, continues to kill residual mature trees. This has resulted in major changes in historical transitions in forest types over broad areas. In moist habitat types, where white pine was historically the dominant species, it has been replaced by species such as grand fir, Douglas-fir, and hemlock which are more susceptible to native disturbances such as bark beetles and root diseases. Efforts to restore white pine are concentrating on planting stock with improved resistance. We are currently intensifying monitoring efforts to gain a better understanding of how well the improved stock is performing over time. In addition, pruning lower branches from young trees is being conducted on a large scale because it can greatly improve survival in some areas.

Blister rust is also causing extensive mortality in high-elevation five-needle pines. Recent surveys in northern Idaho and western Montana high-elevation forests have found infection rates in whitebark pine regeneration of up to 90%. There is a growing concern that severe losses of large diameter whitebark pine due to bark beetles coupled with regeneration losses due to blister rust may have significant impacts on water and wildlife in these fragile ecosystems.

CANKER DISEASES

Atropellis canker

This disease occurs on lodgepole pine and is usually found in groups of pole-sized trees. This disease primarily causes stem defects and topkill; tree mortality is infrequent. The disease is most common in southern Idaho, but can be found sporadically across the entire state.

Cytospora canker

This disease occurs at some level on all *Abies* spp. Infected trees display branch flagging, top killing, and infrequent mortality. The disease is associated with environmental stresses such as drought, frost, and freezing damage. Severely-infected subalpine fir may often be killed by the western balsam bark beetle.

Sphaeropsis blight

This disease is very common on ponderosa pine in many areas throughout Idaho. Damage occurs primarily as a branch or main stem dieback with dead branch tips especially common on exposed portions of tree crowns. Affected trees are often found in riparian areas, although damage can occur on the edges of any ponderosa pine stand. Apparently, disease severity is cyclic and associated with years of prolonged cool, wet weather. This disease does not normally cause tree mortality (except in nursery seedlings) but results in trees with dieback symptoms that may be especially unsightly in recreational and residential areas.

STEM DECAYS

Aspen trunk rot

Decay caused by this fungus occurs most frequently in aspen stands in southern Idaho; damage seems to increase in stands older than 80 years old.

Rust Red stringy rot (Indian Paint fungus)

This fungus is an important cause of heartwood decay of hemlock and *Abies* spp. It causes more than 90% of the decay occurring in these species and is especially damaging in trees older than 60 years. The most extensive damage is usually found in stands with multiple entries. In northern Idaho stands with prolonged periods of cool, wet conditions, usually have the most damage but in southern Idaho decay caused by this fungus is also common in mature and overmature stands of *Abies* spp. in much drier climates.

Red ring rot (White pocket rot)

This important fungus causes white pocket decay on western larch and pine; it occurs less frequently on spruce, Douglas-fir and *Abies* spp. Heartwood decay is produced on mature trees; damage levels vary considerably throughout Idaho.

ROOT DISEASES

Douglas-fir and Abies spp. Are the primary host of root disease and have increased dramatically during the past several decades due to the loss of western white pine, western larch and ponderosa pine from blister rust, fire control, and logging. As a result, root diseases have become the most important diseases in northern Idaho. The most important root pathogens are Phellinus weirii (cause of laminated root disease) and *Armillaria ostoyae* (cause of Armillaria root disease). Many root pathogens are intimately associated with insects (particularly bark beetles) either as vectors or agents that attack and often kill infected trees. Therefore, mortality levels may vary from year to year in response to bark beetle activity.

Annosum root disease

Annosum root disease is separated into two types based on the hosts attacked. The "p-type" attacks pines and is common in ponderosa pine stands in western Montana. Infected trees are frequently found near stumps, which serve as inoculum sources. Importance, distribution, and impact of this root disease varies widely throughout Idaho. Most damage is concentrated in lower elevations where ponderosa pine is the dominant tree species and past harvesting of large trees has been common. Presence of annosum root disease in ponderosa pine stands greatly decreases the potential for managing ponderosa pine. These sites are usually too dry to effectively grow alternative tree species, so preventing the introduction and subsequent increase of annosum root disease is crucial for managing ponderosa pine. The "s-type" of Annosum root disease is widespread at low levels on Douglas-fir and true firs in mixed conifer stands throughout western Montana and northern Idaho. It is frequently found in association with other root diseases.

Armillaria root disease

This pathogen is the most broadly distributed of the root pathogens and the most important disease agent, overall. It frequently occurs in conjunction with annosum root disease, laminated root rot, or brown cubical root and butt rot. Conifers of all species can be killed by *Armillaria* when they are young, but only Douglas-fir, subalpine fir and grand fir remain highly susceptible throughout their lives. Consequently, the damage is much greater in the latter species where severe disease often turns formerly forested sites into permanent shrub fields.

Black stain root disease

Black stain root disease is found infrequently in Idaho. The pathogen may cause pinyon pine mortality (associated with insect attacks) in southern Idaho and occurs on off-site ponderosa pine in some stands in northern Idaho. The fungus is vectored by root-feeding insects and infected trees are usually attacked and killed by bark beetles.

Brown butt rot

Phaeolus schweinitzii causes brown-cubical decay of roots and butts of Douglas-fir and pine species (particularly ponderosa pine). This fungus is a common root inhabitant of Douglas-fir trees of all ages, but causes root decay mostly in mature trees. Trees on poor sites (shallow soils with poor water-holding capacity) are especially prone to damage by this fungus. Infected trees are rarely directly killed by this fungus, but may be predisposed to windthrow and bark beetle attacks.

Laminated root rot

This root pathogen is a major cause of mortality of Douglas-fir and *Abies* spp. in northern Idaho. Losses in some areas are extensive, although distribution of the pathogen within forests varies widely. Some level of disease-associated mortality occurs each year with greater mortality occurring during years of drought stress or high bark beetle populations.

This disease is most severe on sites that historically may have supported mostly western white pine and western larch. These tree species have been replaced by highly susceptible Douglas-fir, grand fir and subalpine fir with consequent increases in this pathogen. It causes damage to trees of all ages, primarily in distinct groups or pockets. This pathogen is often found in conjunction with armillaria and/or annosum root disease, and like *Armillaria*, often converts formerly forested sites to long term shrub fields.

Tomentosus root rot

This disease occurs on Douglas-fir, subalpine fir, Engelmann spruce and lodgepole pine. The pathogen usually causes root and butt decay, often in association with other root-infecting fungi. Pole-sized or larger trees are infected which may increase susceptibility to bark beetle attack and windthrow. The pathogen is most common in southern Idaho, but occurs at low levels throughout the state.

White mottled rot

This root pathogen of aspen is increasing throughout southern Idaho. The disease is frequently found on windthrown trees on the Caribou and Sawtooth National Forests.

DWARF MISTLETOES

Dwarf mistletoes are parasitic seed plants in the genus *Arceuthobium*; they occur on most conifer species in Idaho. In particular, Douglas-fir, western larch, ponderosa and lodgepole pine are seriously infected in certain areas. Western larch overstory trees throughout many stands in northern Idaho are extensively infected with dwarf mistletoe. Douglas-fir and ponderosa pine are infected only in particular stands in northern Idaho. Lodgepole pine dwarf mistletoe is especially damaging in southern Idaho. Suppression projects have continued to remove infected overstory trees. However, dwarf mistletoes remain very widespread and are probably are the most damaging disease in southern Idaho.

Dwarf mistletoes

Lodgepole pine dwarf mistletoe infests approximately 2 million acres (28 percent) of the lodgepole pine type in Region 1 and causes about 18 million cubic feet of growth reduction annually. Douglas-fir dwarf mistletoe infests about .6 million acres (13 percent) of Douglas-fir, reducing growth by approximately 13 million cubic feet annually. Western larch dwarf mistletoe occurs on about .8 million acres (38 percent) of western larch stands, and reduces annual growth by over 15 million cubic feet. Dwarf mistletoe is locally heavy in ponderosa pine stands around Coeur d'Alene, Idaho and along the Spokane River drainage in northern Idaho. Limber pine and whitebark pine are heavily infected in localized areas in Montana, with infection being most prevalent east of the Continental Divide.

FOLIAGE DISEASES

All conifer species are susceptible to foliage diseases but damage varies from year to year. Foliage diseases are usually favored by high moisture, so damage is usually most severe in dense stands and in the lower portions of crowns. Infections generally occur during moist periods in the summer or fall, but damage may not be observed until needles are killed the following spring.

Since most foliage diseases only attack one age class of needles, the very rarely cause tree mortality, but several years of infection may result in reduced growth. However, they may be important problems in Christmas tree and tree improvement plantations where healthy foliage is required. In these cases, direct suppression with fungicides is often warranted.

Elytroderma needlecast

This disease actually grows into small branches where it can perpetuate the disease year after year. In 1996, high levels of infection were noticed throughout many stands in Idaho. Infection was especially severe on the Salmon National Forest where foliage discoloration was noted on more than 9500 acres. In 1997 and 1998, relatively high levels of infection again occurred throughout the state. Localized areas of heavy infection from Elytroderma needle blight were seen in Montana in 1999. Elytroderma has been severe in several areas of western Montana for a number of years, but several new heavily infected areas were reported in 1998 and 1999. This apparent increase in Elytroderma indicates that favorable weather conditions for infection probably occurred during the summers of 1997 and 1998.

Lodgepole pine needlecast

Lophodermella concolor causes cyclic damage on lodgepole pine throughout Idaho. In southern Idaho, the disease appears following periods of drought. In northern Idaho, extensive damage is evident in the early spring in some stands. Although damage varies from year to year, it is difficult to predict future disease levels based on observations of spring weather conditions. High levels of infection make trees appear extensively damaged. However, the disease usually has no prolonged effects on infected trees although growth may be temporarily reduced. An exception is in tree improvement plantations where growth reductions seriously affect tree performance.

Rhabdocline needle casts
This disease occurs on young Douglas-fir throughout Idaho; it is particularly noticeable in some stands in northern Idaho and may cause extensive defoliation on young trees. Christmas tree production has been greatly reduced or eliminated in certain parts of northern Idaho because of this disease.

Swiss needle cast
This is another foliage disease of Douglas-fir that occurs throughout northern Idaho. In recent years, infection levels have increased, probably because of increasing fungal inoculum and conducive spring weather. Affected trees may have chlorotic thinning crowns as foliages is slowly killed and needle retention is reduced.

Larch needle diseases
Larch needlecast is caused by *Meria laricis* and needleblight is caused by *Hypodermella laricis*. Both diseases are generally cyclical, occurring at high levels during years of prolonged cool, moist weather in the spring and early summer. In 1996, these diseases were epidemic throughout central Idaho; they were apparently associated with a late June frost. More than 88,000 acres were damaged on the Payette and northern portions of the Boise National Forests. However, disease incidence in 1997 and 1998 declined, primarily due to increased defoliation by larch casebearer.

Fir broom rust
This disease is widespread throughout Idaho. Although the disease is usually of little consequence, high disease levels occur in some stands south of the Snake River in southern Idaho.

Spruce broom rust
This disease is scattered throughout spruce stands in Idaho. It appears most common in certain stands in eastern Idaho.

Cedar apple rust (Gymnosporangium rusts)
In eastern Idaho, this disease causes a leaf spot on residential apple trees in Challis and Salmon, Idaho and on *Amelanchier* spp. throughout the range of serviceberry in eastern Idaho.

Conifer-aspen rust and conifer-cottonwood rust
In 1996, an epidemic of this rust disease occurred throughout the range of *Populus* spp. in southern Idaho. In 1997, the fungus was not observed on its main conifer host (Douglas-fir); it is possible that the fungus overwintered on its *Populus* hosts due to mild winters. In 1998, disease occurrence was light, probably because of competition with other foliage diseases related to late frosts.

Miscellaneous foliage diseases
Fir needlecast on subalpine and grand fir occurred at low levels from 1996-1998 throughout Idaho. Ponderosa pine needle rust occurred at light to moderate levels. Red band needle blight remained at fairly high intensity on ponderosa pine in some locations, such as along the Lochsa River in northern Idaho. White pine needlecast has declined dramatically during the past few years. Marssonina blight and Shepard's Crook occurred at epidemic proportions during 1996-1998 in central and eastern Idaho. Affected trees had brown-colored foliage from mid-July until leaf drop in the fall.

NURSERY DISEASES

Fusarium root disease

The most important pathogens affecting both bareroot and container nurseries are caused by species of *Fusarium* which cause damping-off and root diseases of young seedlings. *Fusarium oxysporum* is especially important in bareroot nurseries, whereas *F. proliferatum* is a major pathogen in container nurseries. Other *Fusarium* spp. which commonly cause nursery diseases include *F. solani, F. sporotrichioides, F. avenaceum, F. acumination, and F. sambucinum.* Although other *Fusarium* spp. are often isolated from diseased seedlings, they are usually considered as either saprophytes or very weak pathogens. Damage levels during 2000 were normal at most nurseries. *Fusarium* diseases are most commonly controlled by pre-plant soil fumigation in bareroot nurseries and seed and fungicide treatments in container nurseries.

Cylindrocarpon root disease

Cylindrocarpon destructans causes root disease of container-grown five-needle pines (western white pine, whitebark pine) at several container nurseries in Region 1. The pathogen always causes at least low levels of root decay, often without eliciting above-ground disease symptoms on affected seedlings. The disease is best controlled by container sterilization, seed treatments, and periodic fungicide applications.

Gray mold

Botrytis cinerea is an important disease of container-grown western larch, Engelmann spruce, western red cedar, and western white pine seedlings in container nurseries in Region 1. Damage from this pathogen during 2000 was about average; some western larch seedlots were extensively damaged at one nursery. This disease is best prevented by careful monitoring and sanitation procedures. When the disease is discovered, fungicide applications, alternating several different chemicals, are implemented. *Botrytis* can also cause important damage to cold-stored seedlings after lifting and prior to outplanting. Storing seedlings at below-freezing temperatures and rapidly thawing them prior to outplanting restricts pathogen development.

Pythium root disease

Root diseases caused by *Pythium* spp. are common in poorly drained portions of bareroot seedling beds. Root diseases of bareroot western larch seedlings associated with *P. irregulare*, *P. ultimum*, and *P. aphanidermatum* were damaging at the USDA Forest Service Nursery in Coeur d'Alene, Idaho during 2000. Affected beds were treated with fungicide drenches, which reduced disease severity.

Phytophthora root disease

Root diseases caused by *Phytophthora cactorum* and *P. megasperma* were damaging in low, poorly drained portions of 2-0 western larch seedbeds at the USDA Forest Service Nursery in Coeur d'Alene, Idaho in 2000. Affected seedlings were treated with fungicide drenches, which helped reduce disease impacts.

Tip dieback

During 2000, extensive tip dieback caused by *Sirococcus conigenus* occurred on 2-0 ponderosa and lodgepole pine seedlings at the USDA Forest Service Nursery in Coeur d'Alene, Idaho. The disease caused more damage than normal because of prolonged cool, wet spring weather that persisted in northern Idaho. Fungicide applications were not very effective in limiting disease buildup until warmer and drier weather occurred in early summer.

Damping-off

Damping-off is common in both bareroot and container nurseries in Region 1. Disease levels vary widely among different seedlots because much of the inoculum is seedborne. Damage is most often controlled by pre-sowing seed treatments (especially prolonged running water rinses and treatments with aqueous solutions of sodium hypochlorite) and application of post-sowing fungicides during periods of high germinant susceptibility and conducive temperature and moisture conditions.

NURSERY DISEASE PROJECTS

Efforts have been underway the past several years to develop alternatives to pre-plant soil fumigation with methyl bromide/chloropicrin. Several tests were installed at two Idaho bareroot nurseries to evaluate alternative soil treatments and determine their effects on production of bareroot conifer seedlings. In general, one Idaho nursery adopted an alternative chemical fumigant (dazomet) which seems to be as effective as methyl bromide. However, the other nursery has yet to effectively replace methyl bromide fumigation. Bare fallowing fields with periodic cultivation for at least one year prior to sowing a seedling crop is effective in some fields, but not in others. By fallowing, pathogen populations naturally decrease because of lack of adequate food sources for saprophytic activity. In some cases, amending fallowed fields with antagonistic biological control fungi (primarily *Trichoderma harzianum*) has improved disease control. Solarization treatments (covering soil with a plastic tarp during the summer preceding sowing) show promise at one Idaho nursery. Organic amendments (sawdust, composted mushroom waste, cover crop incorporation) generally are not effective because the added organic matter is used by soil pathogens to increase their populations. Higher pathogen populations directly result in greater levels of seedling diseases. Efforts are continuing to develop alternatives to pre-plant soil fumigation at bareroot nurseries. It appears that efficacious alternatives will have to be specific for each nursery. It is hoped that eventually growers will be able to produce high quality forest tree seedlings without soil fumigation.

Since *Fusarium* spp. are generally the most important nursery pathogens in Idaho, work has continued to evaluate epidemiological characteristics of these important pathogens. As part of this work, tests were conducted to evaluate pathogenic potential of several different *Fusarium* species on conifer seedlings under controlled conditions. Tested species included *F. oxysporum, F. sporotrichioides, F. solani* and *F. acuminatum*. In general, all of these species contain both pathogenic and non-pathogenic isolates. A larger proportion of the *F. oxysporum* population is comprised of pathogenic isolates than was found for the other species. However, pathogenic strains of all species were isolated from both diseased and non-diseased conifer seedlings. Genetic characterization of *Fusarium* populations within selected nurseries would yield important information that could be used directly to reduce impact of these important pathogens.

Extensive work at a tree improvement/seed orchard plantation near Lewiston, Idaho indicated that root-pathogenic fungi can be important in such plantations. Although tree mortality may not always occur, root pathogens can adversely affect seed production and seriously impact tree growth. *Phytophthora* spp. (particularly *P. cactorum* and *P. pseudotsugae*) have been isolated frequently from dead and/or declining trees. Some of the pathogen inoculum occurs on the planting site, but infection of nursery stock prior to planting cannot be ruled out. Reduction of on-site pathogen inoculum was obtained at the seed orchard by summer solarization with a plastic tarp during the year prior to planting.

STATUS OF CHRONIC DISEASE PROBLEMS		
DISEASE	**HOST**	**LOCATION/REMARKS**
STEM & BRANCH DISEASES		
Aspen trunk rot	Aspen	Decay occurs in most aspen stands in southern Idaho and is increasingly common as stands age exceeds 80 years.
Atropellis canker	Lodgepole pine	Found in pockets in pole sized stands causing defect, topkill, and some mortality.
Comandra blister rust	Lodgepole pine/ponderosa pine	Infection occurs infrequently throughout Idaho. Heavy, localized areas of infection resulting in branch, top, and entire tree mortality of sapling-size ponderosa pines occurs in offsite plantations on southern Idaho.
Cytospora canker	True firs	Branch flagging, top killing, and mortality attributed to this fungus occurs wherever host are found. This disease is associated with environmental stress damage, drought, frost, and freezing. Western balsam bark beetles frequently kill the diseased trees.
Sphaeropsis blight	Ponderosa pine	Is causing widespread branch dieback in many Idaho areas; especially common in riparian areas.
Dwarf mistletoes	Douglas-fir, western larch,	Suppression projects continue to remove infected

	lodgepole and ponderosa pine	overstory trees; however this forest disease remains the most widespread and damaging throughout the state.
Indian paint fungus	True firs, hemlock	Causes 90 percent of decay in these species throughout the state; especially common as age increases beyond 60 years. Common in mature and overmature stands of true firs throughout southern Idaho
Pinyon blister rust	Pinyon pine	This disease occurs in the Raft River Mountains on the Sawtooth National Forest
Red ring rot	Western larch, true firs, Douglas-fir, pines, spruce	Can cause serious decay problems in mature conifers. Infection intensity varies throughout host stands in southern Idaho.
Stalactiform blister rust	Lodgepole pine	This rust occurs in localized areas throughout the host type. Heavy infection has been in very localized areas of the Boise, Payette, Sawtooth, and Targhee NF's.
Western gall rust	Lodgepole and ponderosa pine	Gall rust occurs throughout the host types. Infection levels vary, with localized heavy infection present in both host species.
White pine blister rust	Western white pine, limber pine, whitebark pine	This introduced disease is common throughout its host ranges in Idaho. A formal survey of five-needled pines was conducted in 1995-1997 in southern Idaho to quantify disease incidence and intensity, and determine site and stand characteristics of infected areas.
ROOT DISEASES		
Annosus root disease	Pines, true firs, Douglas-fir, spruce	Causes mortality, root and butt rot especially in young trees near old stumps; frequently in complexes with other root diseases; may predispose trees to windthrow and/or bark beetles. This root disease fungus can be found on pines throughout southern Idaho and on firs and spruce in northern Idaho.
Armillaria root disease	Douglas-fir, grand fir, other conifers especially when young and improperly planted	In northern Idaho, a widespread killer of all sizes of trees; In southern Idaho usually found as a weak pathogen or saprophyte causing little direct mortality or in complexes with other root diseases.
Black stain root disease	Pines, Douglas-fir	Found infrequently in Idaho; caused pinyon pine mortality in southern Idaho; usually in association with other root diseases.
Laminated root rot	Douglas-fir, true firs, occasionally other conifers	Primary killer in many stands from the Nez Perce NF north; may be found with Armillaria or other root diseases.
Schweinitizii root rot	Douglas-fir, pines	This decay is common in mature and overmature forests throughout the host type, especially those with a frequent fire or logging history. The fungus is often associated with other root pathogens and bark beetle activity.
Tomentosus root disease	Douglas-fir, subalpine fir, Engelmann spruce, lodgepole pine	Usually found as root/butt rot with other root diseases; occasionally causes mortality. It causes root and butt rot of pole sized and larger trees, predisposing them to bark beetle attack and windthrow. Most common in southern Idaho, but present throughout the state.
White mottled rot	Aspen	This pathogen is increasing in incidence throughout southern Idaho. The disease can be found on windthrown aspen on the Caribou and Sawtooth National Forest.
FOLIAGE DISEASES		
Cedar apple rust	Juniper, Apple, Serviceberry	In eastern Idaho, this disease caused a leaf spot on residential apple trees in Challis and Salmon, ID and to *Amelanchier* throughout the range of serviceberry in eastern Idaho.
Conifer-Aspen rust Conifer-Cottonwood rust	Aspen, cottonwood, conifers	In 1996 epidemic throughout the host range of all Populus species. In 1997 the fungus has not been observed recently on main conifer host, Douglas-fir, so it may be overwintering on *Populus* due to mild winters. In 1998 occurrence was light due to late frost competition with other foliage diseases.

Rhabdocline needle casts	Douglas-fir	Very widespread but relatively light levels statewide.
Swiss needlecast	Douglas-fir	Widespread in northern Idaho; generally at very low levels of infection.
Elytroderma needlecast	Ponderosa pine	Systemic and annual infections occur throughout the host type. Infection was especially severe on the Salmon National Forest.
Fir broom rust	True firs	Widespread throughout the state; usually of little consequence, but is "extremely common" in stands south of the Snake River in southern Idaho.
Fir needlecast	Subalpine fir Grand fir	Infection occurred at low levels throughout the host type.
Fir needle rust	Subalpine fir	Scattered infection occurs on seedlings and sapling trees throughout the host type.
Larch needle disease	Larch	Incidence and severity of infection in west central Idaho is cyclical. Following a late frost in June, 1996 over 88,000 acres of damage was found on the Payette and northern Boise National Forest. In 1997 and 1998 these diseases were overshadowed by the larch casebearer.
Lodgepole pine needlecast	Lodgepole pine	Infection intensity is worse following periods of drought. During intervening years, the disease is of minor localized importance.
Marssonina blight Shepard's crook	Aspen	In 1996 -1998 the disease was epidemic in central and eastern Idaho. Affected trees had brown colored foliage from mid-July until leaf drop.
Pine needle rust	Pines	Scattered incidence of light to moderate intensity scattered throughout the host types in southern Idaho.
Spruce broom rust	Engelmann spruce	Scattered through host range; most common in eastern Idaho.
White pine needlecast	Western white pine	Infections declined dramatically in 1999-2000.
NURSERY DISEASES		
Cylindrocarpon	Western white pine whitebark pine	Common in soil or contaminated containers, usually a saprophyte but may be a weak parasite, caused losses at several nurseries.
Diplodia tip blight	Pines	Low levels in areas with a history of problems.
Fusarium root disease	Douglas-fir, larch, spruce, others	The most common and widespread nursery disease; amount of damage varies widely. This disease causes small amounts of mortality primarily of 1-0 conifer seedlings at the Lucky Peak Nursery in Southern Idaho.
Grey mold	most conifers, esp. larch, spruce	Common at low levels in many nurseries. Can be a serious problem during seedlings storage.
Meria needlecast	Larch	Infection levels are very low.
Phoma blight	Pines	Commonly isolated from seedlings and soil samples.
Phytophthora/Pythium root rot		These fungi occur infrequently on seedlings and in soil at Lucky Peak Nursery in southern Idaho. Infection results in patch mortality and culling of 2-0 seedlings.
Sirococcus tip blight	Spruce, Pines	Found at low levels at several nurseries.

COMMON AND SCIENTIFIC NAMES OF INSECTS

Balsam woolly adelgid	*Adelges picea* (Ratzburg)
Black-headed budworm	*Acleris gloverana*
Boxelder leafroller	*Caloptilia negundella* (Chambers)
California five-spined Ips	*Ips paraconfusus* Lanier
Cone feeding adelgid	*Pineus coloradensis* (Gillette)
Cone moth	*Eucosma recissoriana* Heinrich
Cone worms	*Dioryctria* spp.
Cranberry girdler moth	*Chrysoteuchia topiaria* (Zeller)
Douglas-fir beetle	*Dendroctonus pseudotsugae* Hopk.
Douglas-fir tussock moth	*Orgyia pseudotsugata* McDunnough
Fir engraver	*Scolytus ventralis* LeConte
Gypsy moth	*Lymantria dispar* (L.)
Lodgepole terminal weevil	*Pissodes terminalis* Hopping
Lodgepole needleminer	*Coleotechnites milleri* Busck
Mountain pine beetle	*Dendroctonus ponderosae* Hopk.
Pine engraver	*Ips pini* (Say)
Pine needle sheath miner	*Zelleria haimbachi* Busck
Red turpentine beetle	*Dendroctonous valens* Le Conte
Rusty tussock moth	*Orgyia antiqua* (L.)
Spruce beetle	*Dendroctonus rufipennis* (Kirby)
Tip moth	*Rhyacionia zozara* (Kearfott)
Western balsam bark beetle	*Dryocoetes confusus* Swaine
Western conifer seedbug	*Leptoglossus occidentalis* Heidmann
Western pine beetle	*Dendroctonus brevicomis* LeConte
Western pine shootborer	*Eucosma sonomana* Kearfott
Western spruce budworm	*Choristoneura occidentalis* Freeman

COMMON AND SCIENTIFIC NAMES OF DISEASES

Annosus root disease	H*eterobasidion annosum* (Fr.) Bref.
Armillaria root disease	*Armillaria ostoyae* (Romagn.) Herink
Atropellis canker	*Atropellis piniphila* (Weir) L. & H.
Black stain root disease	*Leptographium wagneri* (Kendr.) Wingf.
Brown cubical butt rot	*Phaeolus schweinitzii* (Fr.) Pat.
Comandra blister rust	*Cronartium comandrae* Pk.
Conifer-aspen rust	*Melampsora medusae* Thum.
Conifer-cottonwood rust	*Melampsora occidentalis* Jacks.
Cylindrocarpon root disease	*Cylindrocarpon* spp.
Cytospora canker of firs	*Cytospora abietis* Sacc.
Diplodia tip blight	*Sphaeropsis sapinea* (Fr.) Dyko
Dutch elm disease	*Ophiostoma ulmi* (Buism.) Nannf.
Dwarf mistletoes	*Arceuthobium* spp.
Elytroderma needlecast	*Elytroderma deformans* (Weir) Dark.
Fir broom rust	*Melampsorella caryophyllacearum* Schroet.
Fir needlecast	*Lirula abietis-concoloris* (Mayr:Dearn) Darker
Fir needle rust	*Pucciniastrum epilobii* Otth
Fusarium root disease	*Fusarium* spp.
Grey mold	*Botrytis cinerea* Pers. ex Fr.
Indian paint fungus	*Echinodontium tinctorium* (Ell.& Ev.)Ell.& Ev.
Laminated root rot	*Phellinus weirii* (Murr.) Gilb.
Larch needle blight	*Hypodermella laricis* Tub.
Larch needlecast	*Meria laricis* Vuill.
Lodgepole pine needlecast	*Lophodermella concolor* (Dearn.) Dark.
Marssonina blight	*Marssonina populi* (Lib.) Magn.
Phoma blight	*Phoma* spp.
Pine needle rust	*Coleosporium sp.*
Pythium root disease	*Pythium ultimum* Trow.
Red ring rot	*Phellinus pini* Pilat.
Rhabdocline needle cast	*Rhabdocline pseudotsugae* Syd. *Rhabdocline weirii* Parker & Reid
Schweinitzii root/butt rot	*Phaeolus schweinitzii* (Fr.) Pat.
Shepard's crook	*Venturia macularis* (Fr.) E.Muller & Von Arx

Sirococcus tip blight	*Sirococcus strobilinus* Preuss.
Stalactiform rust	*Cronartium coleosporioides* (Diet. & Holw.) Arth.
Spruce broom rust	*Chrysomyxa arctostaphyli* Diet.
Spruce mottled needlecast	*Rhizosphaeria kalkhoffii* Bud.
Swiss needle cast	*Phaeocryptopus gaeumannii* (Rhode) Pet.
Tomentosus root rot	*Inonotus tomentosus* (Fr.) Gilb.
Western gall rust	*Endocronartium harknessii* (Moore) Hir.
White pine blister rust	*Cronartium ribicola* Fisch.
White pine needlecast	*Lophodermella arcuata* (Darker) Darker

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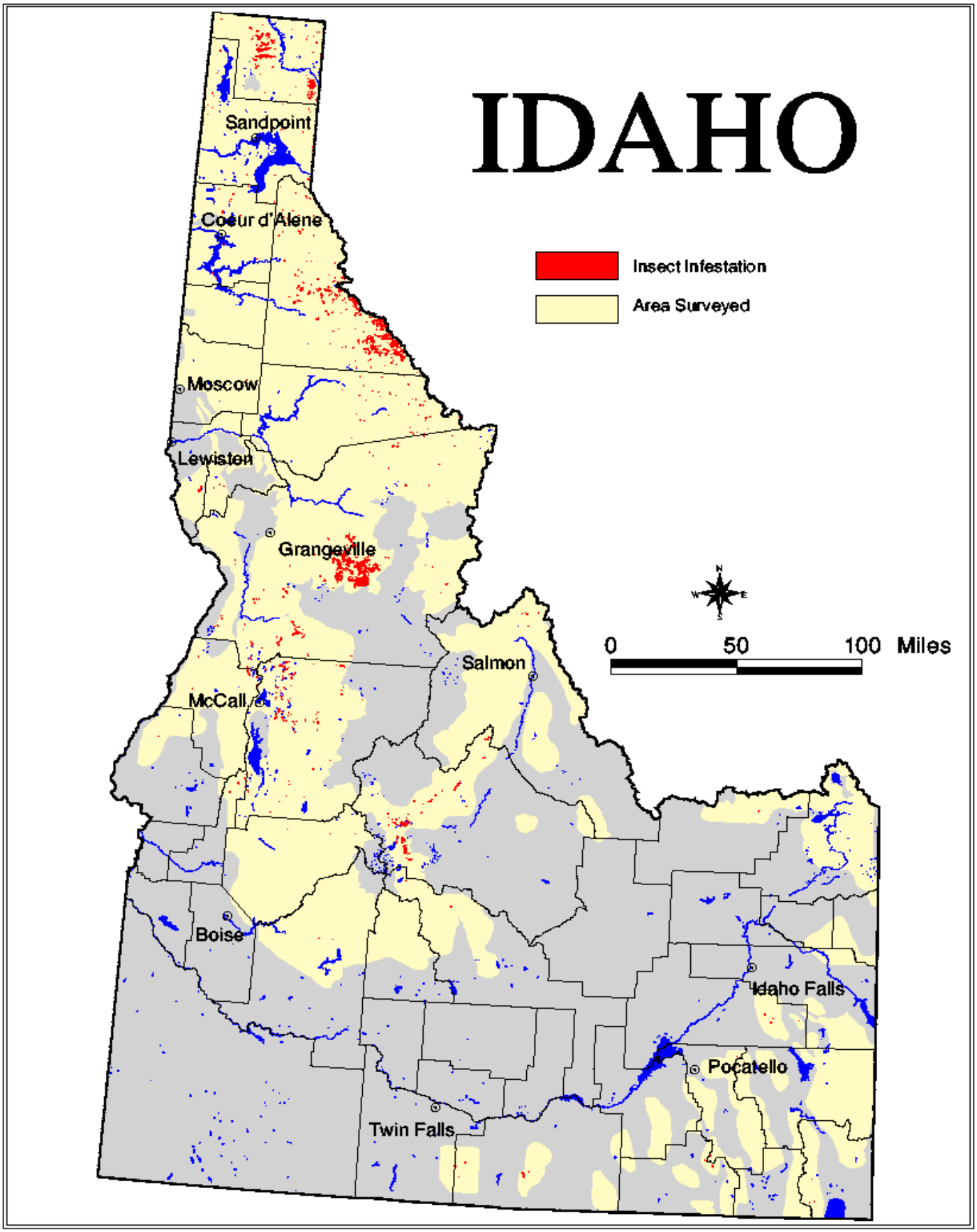
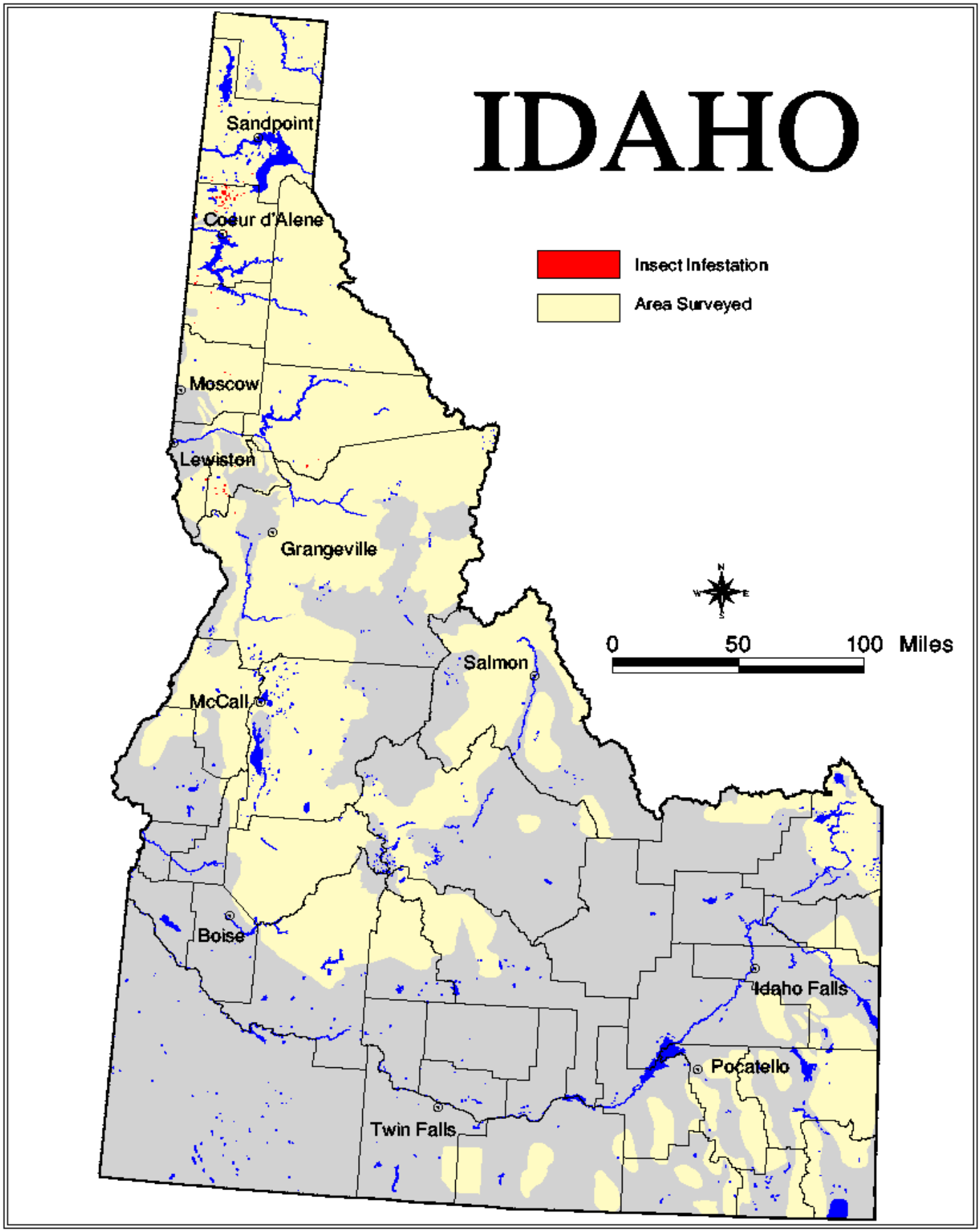
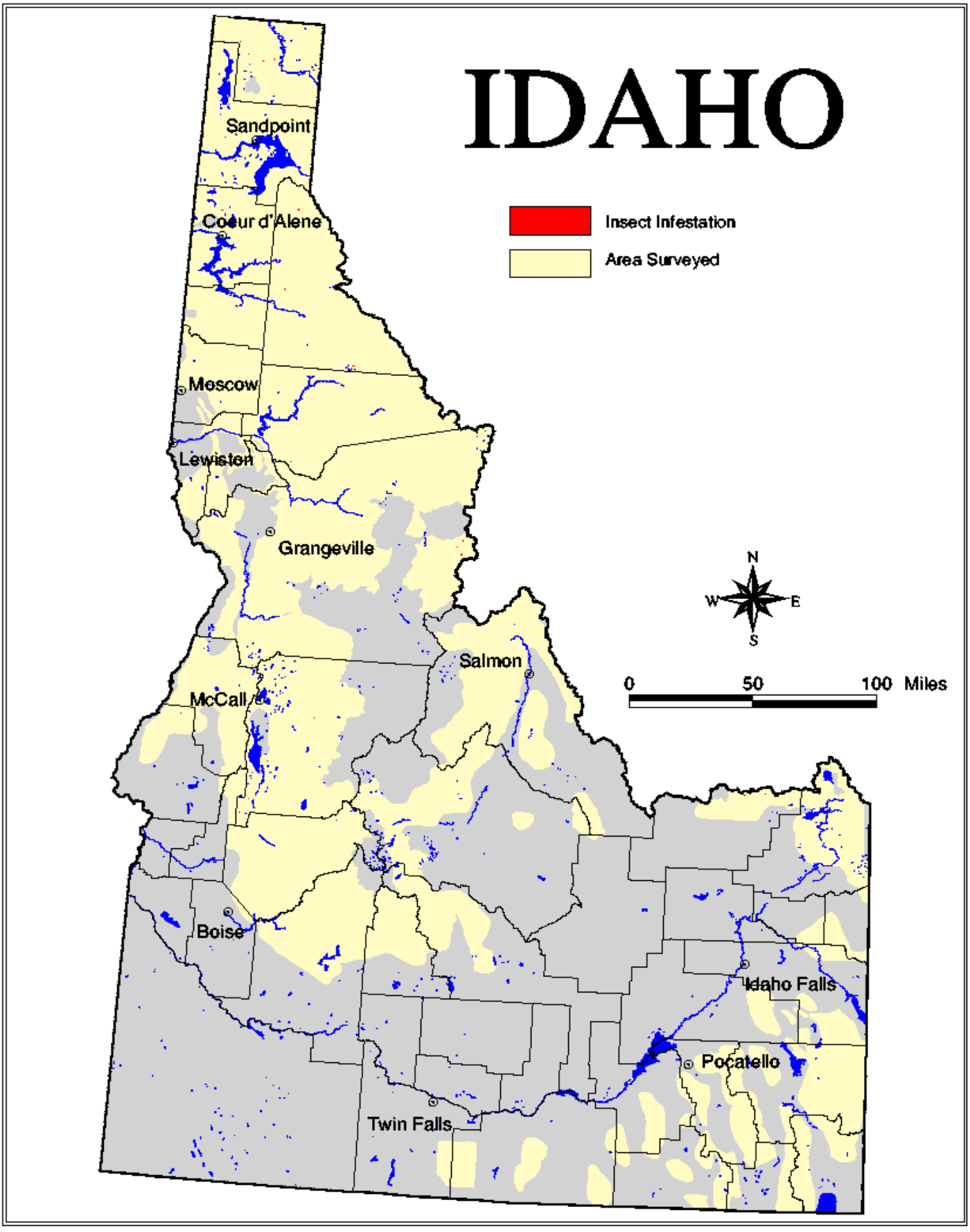


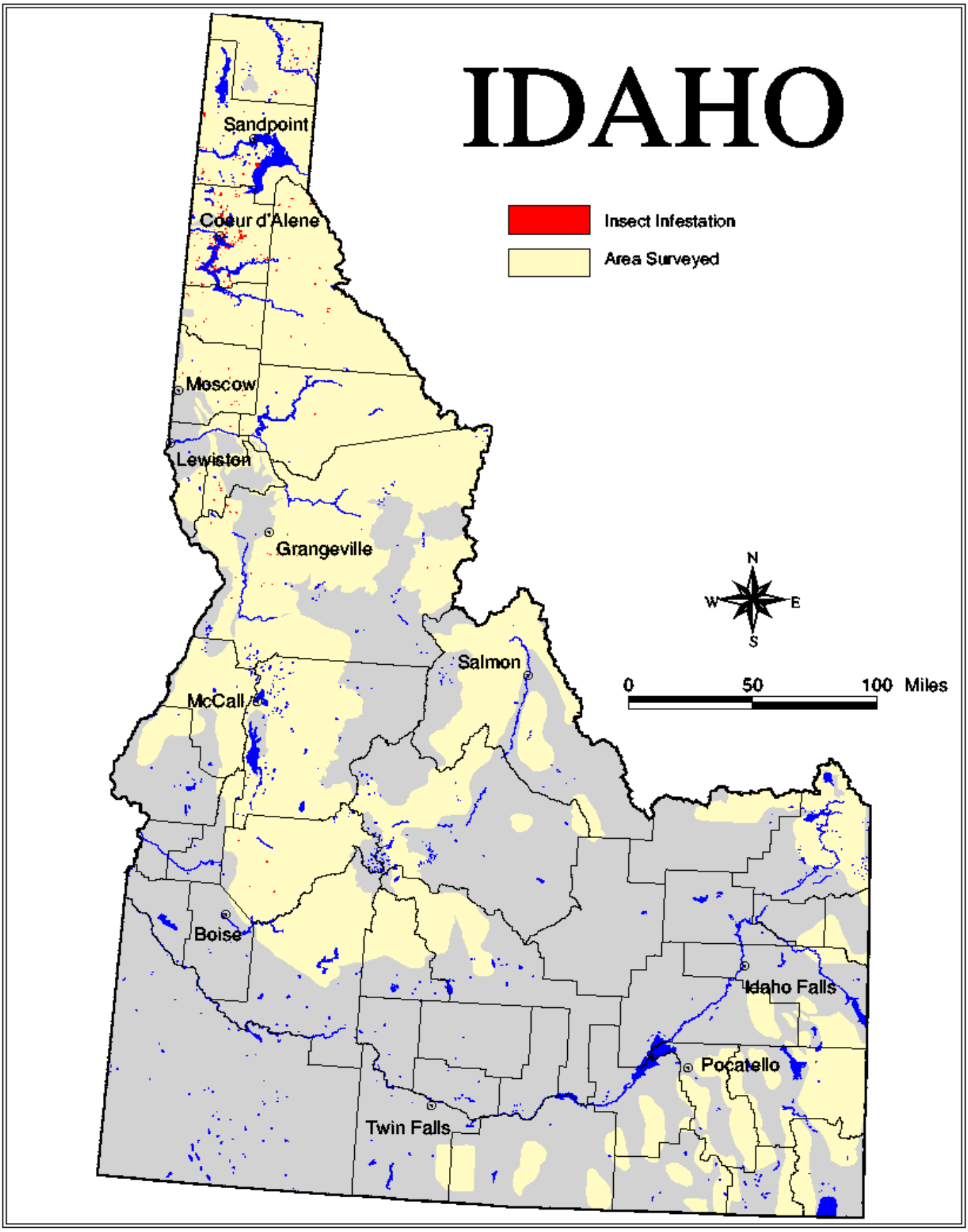
Map 99-1 Areas of Mountain pine beetle infestations in Idaho in 1999



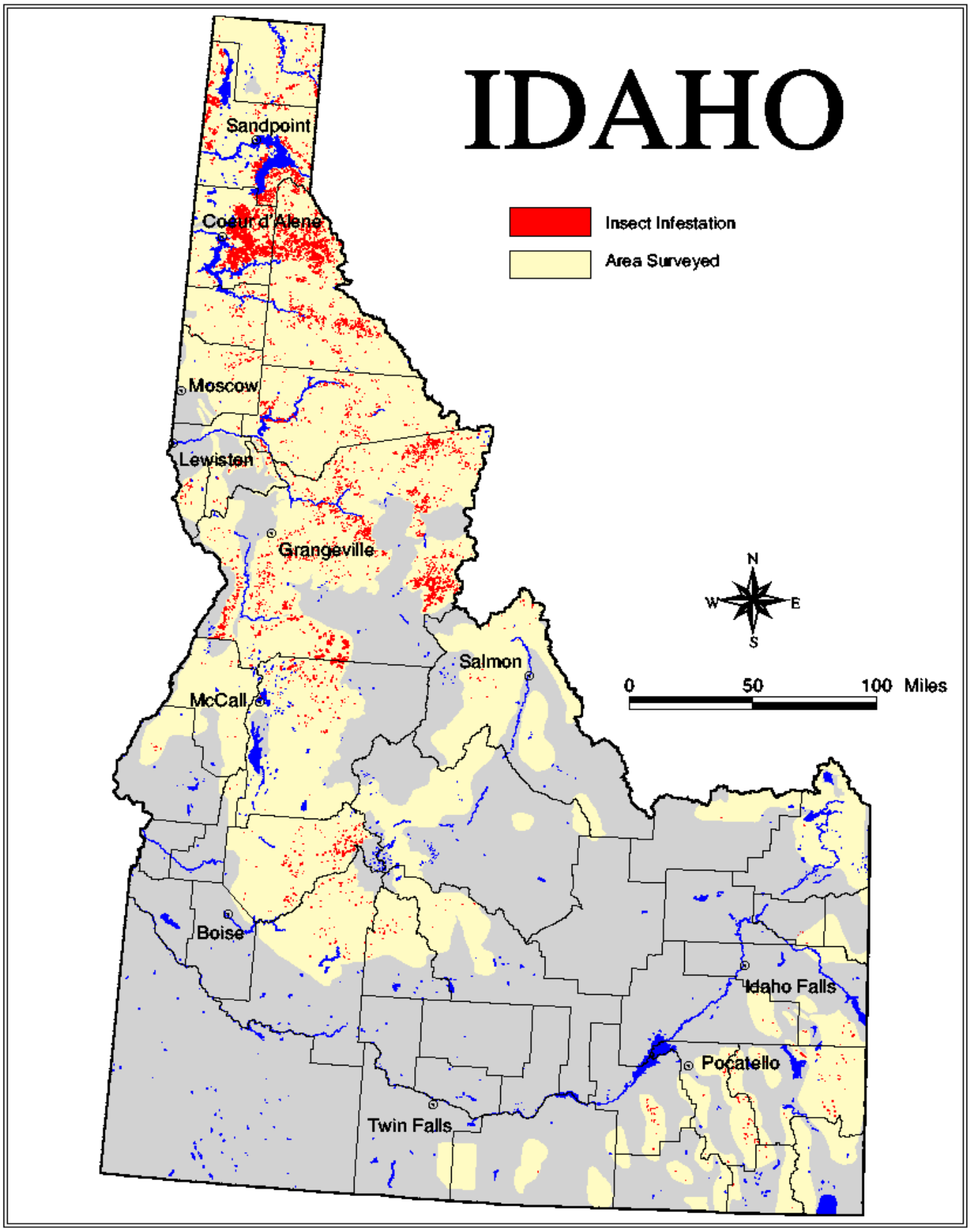
Map 99-2 Areas of Pine engraver beetle infestations in Idaho in 1999



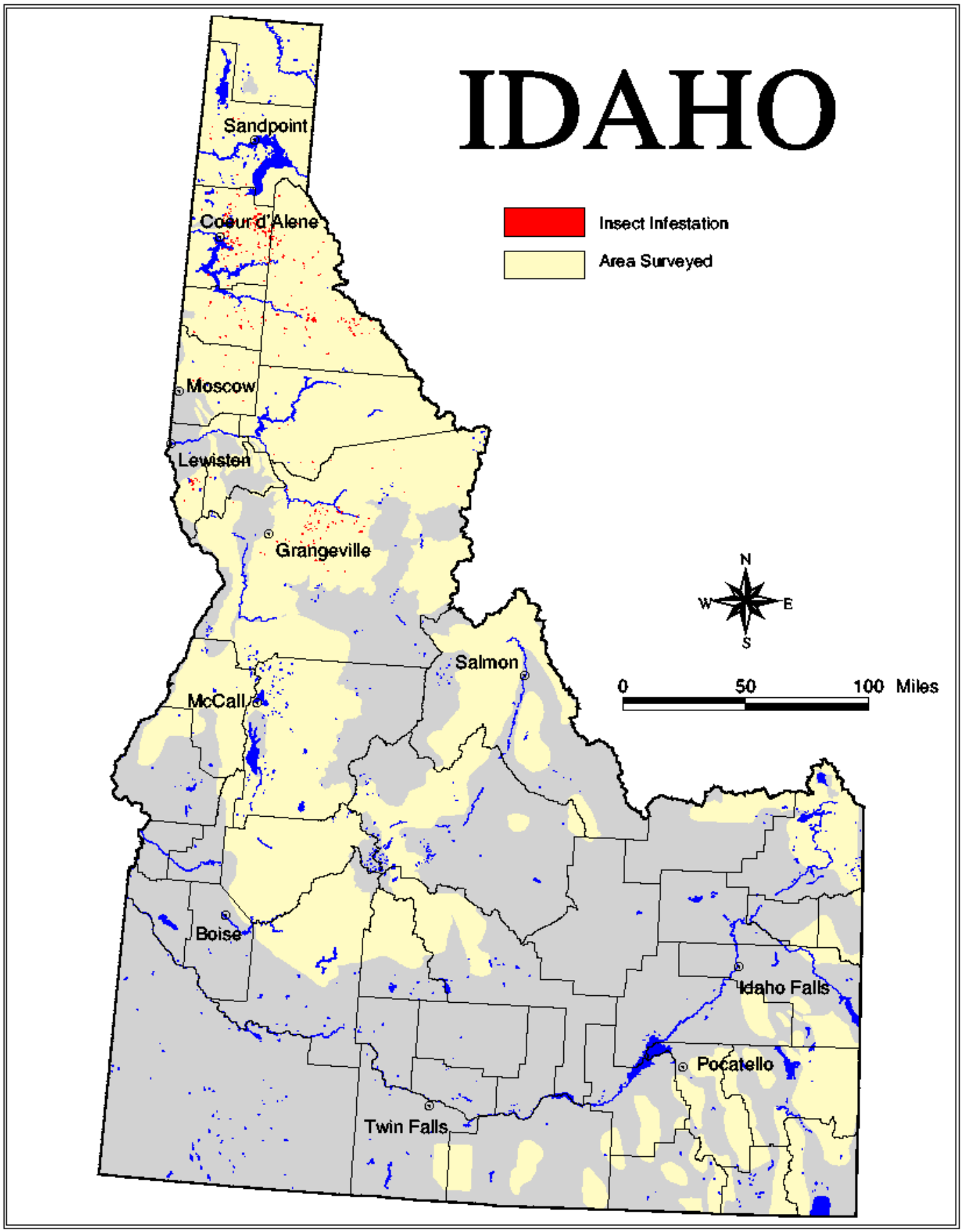
Map 99-3 Areas of Western pine beetle infestations in Idaho in 1999



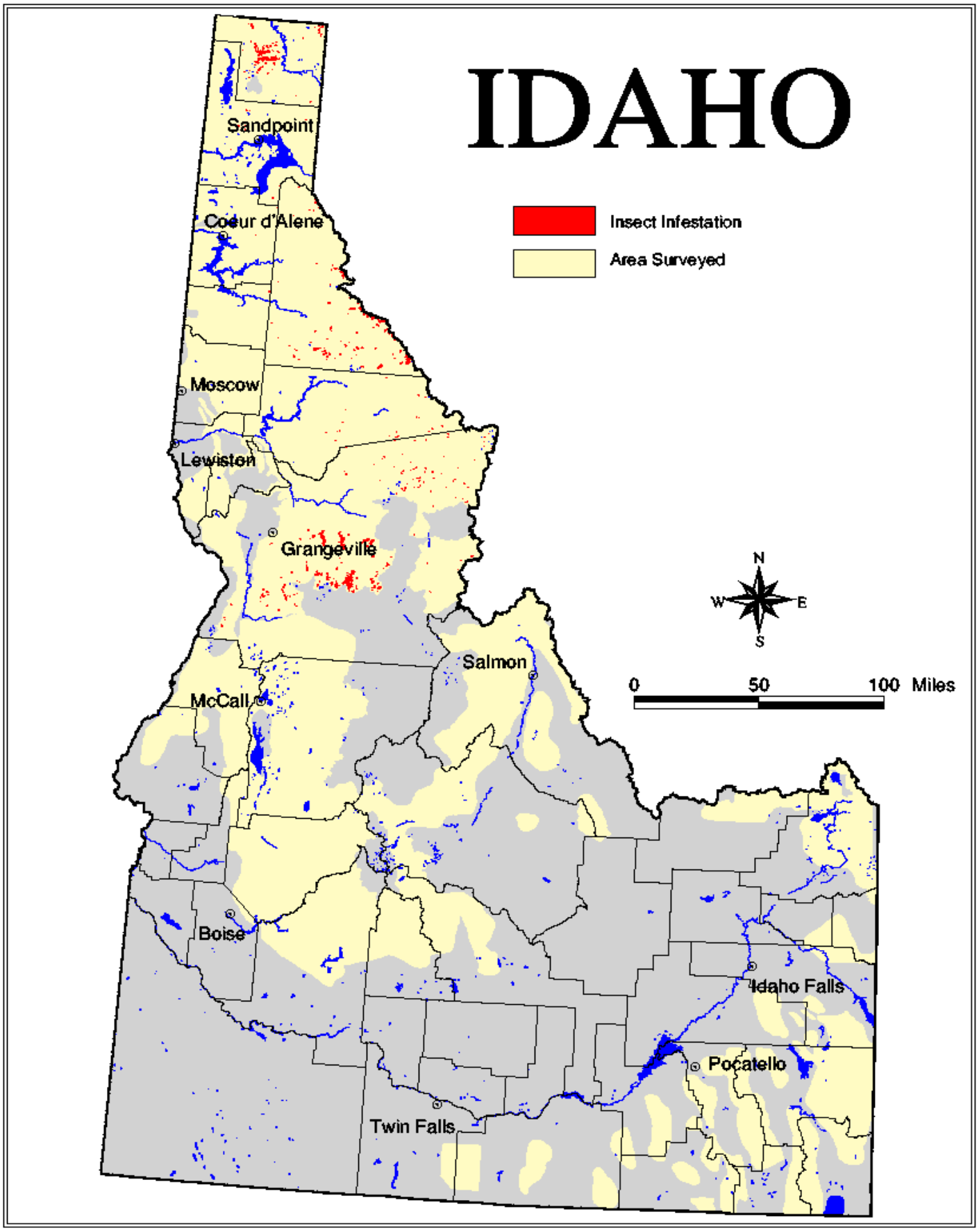
Map 99-4 Areas of Spruce beetle infestations in Idaho in 1999



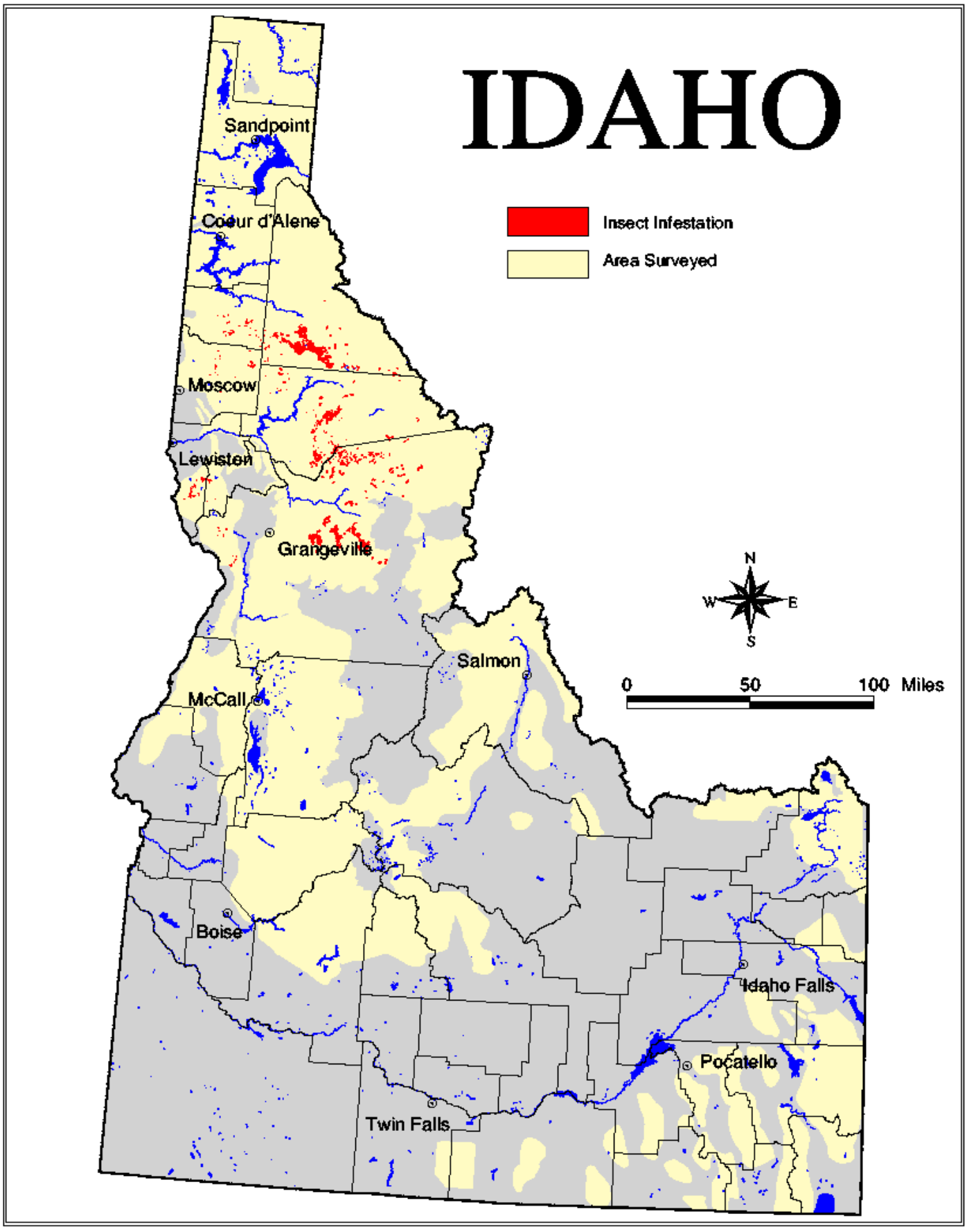
Map 99-5 Areas of Douglas-fir beetle infestations in Idaho in 1999



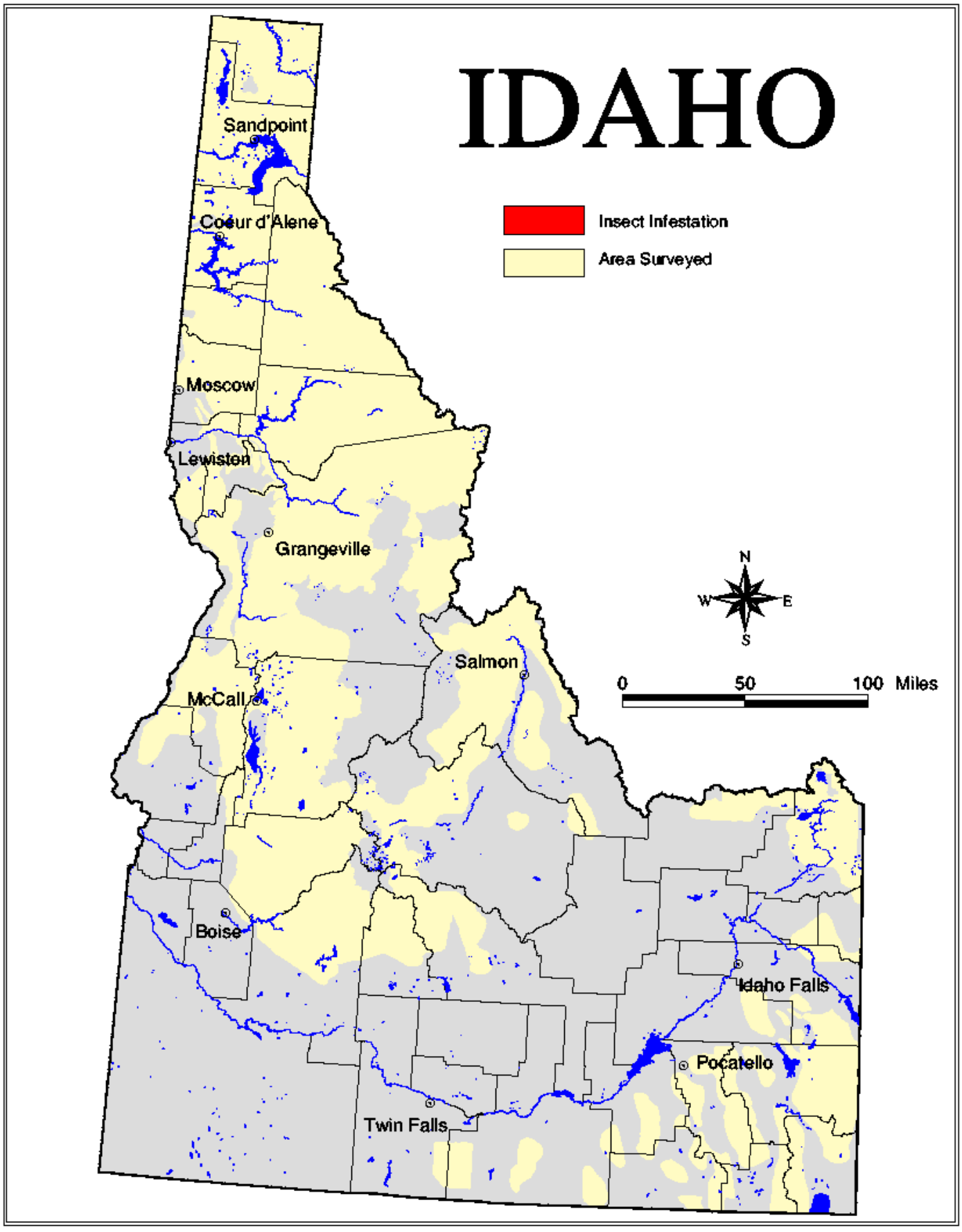
Map 99-6 Areas of Fir engraver infestations in Idaho in 1999



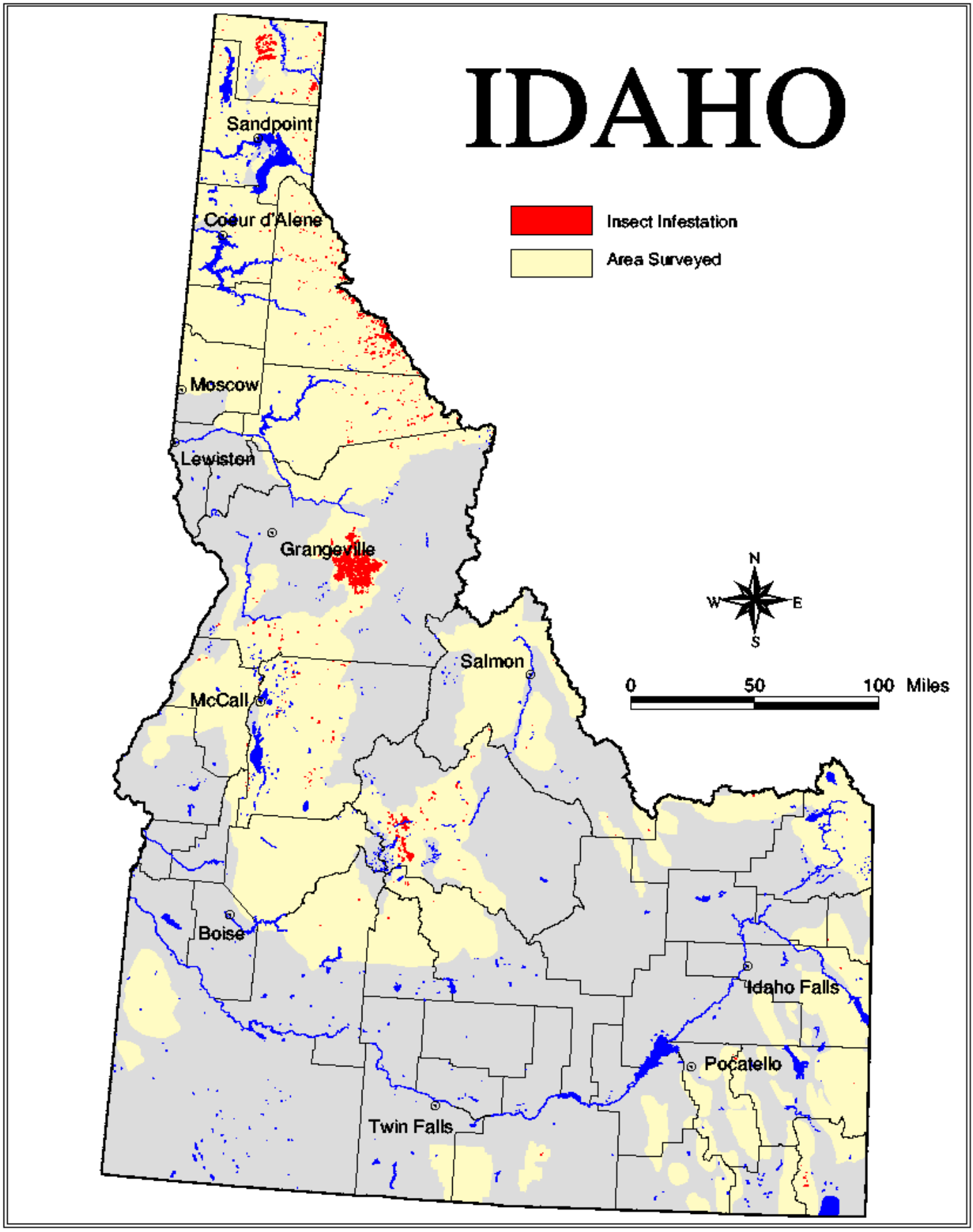
Map 99-7 Areas of Western balsam bark beetle infestations in Idaho in 1999



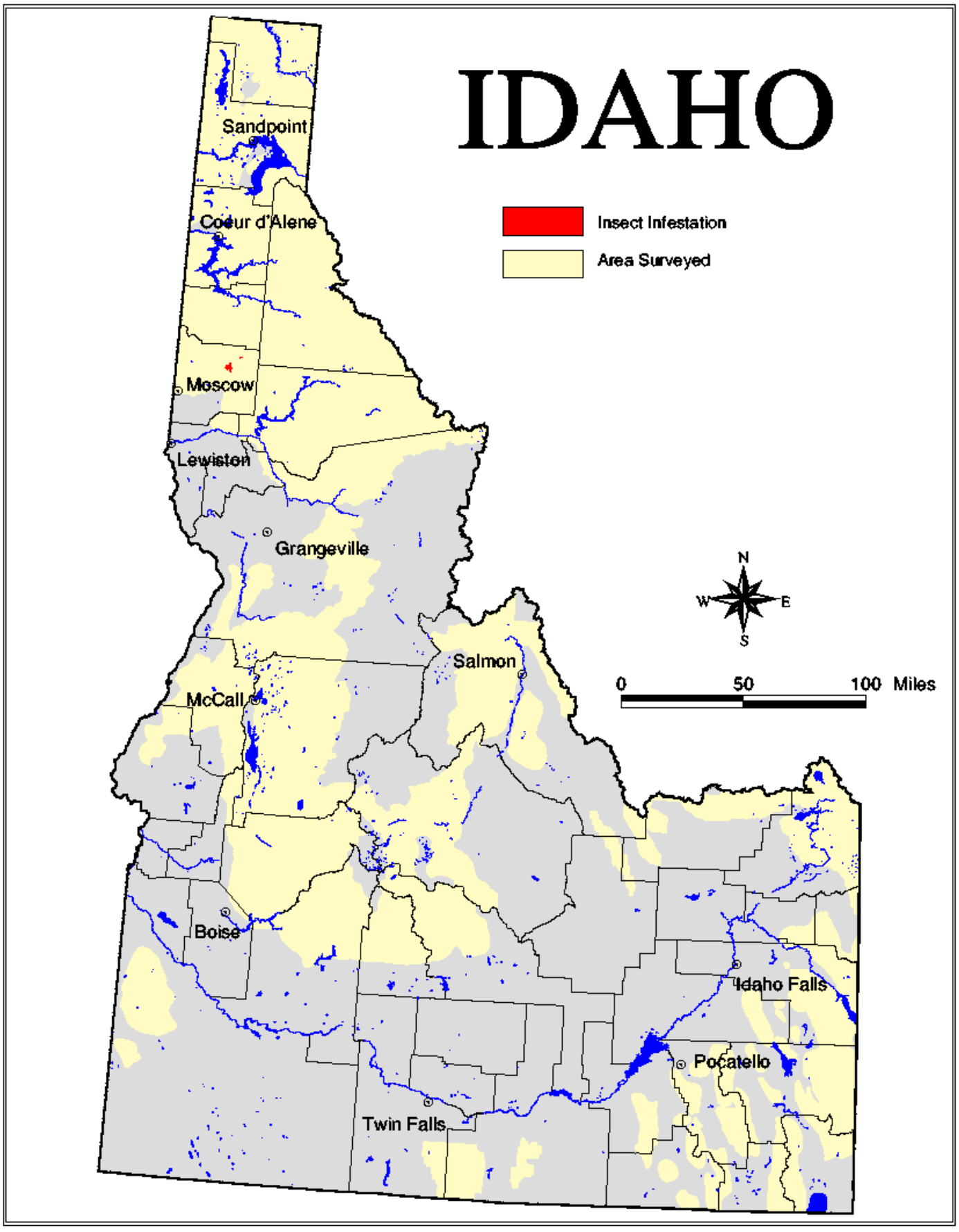
Map 99-8 Areas of Balsam woolly adelgid infestations in Idaho in 1999



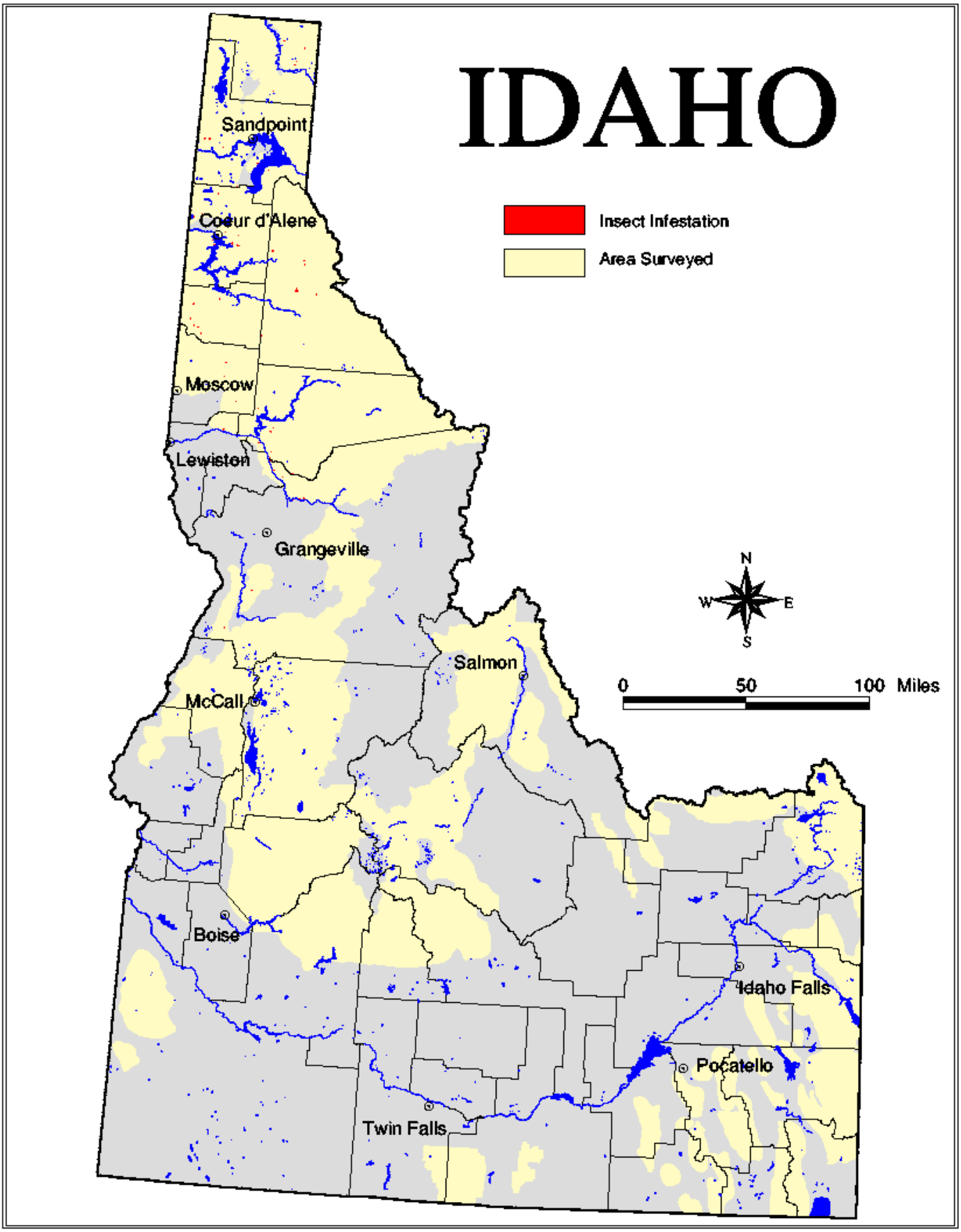
Map 99-9 Areas of Douglas-fir tussock moth infestations in Idaho in 1999



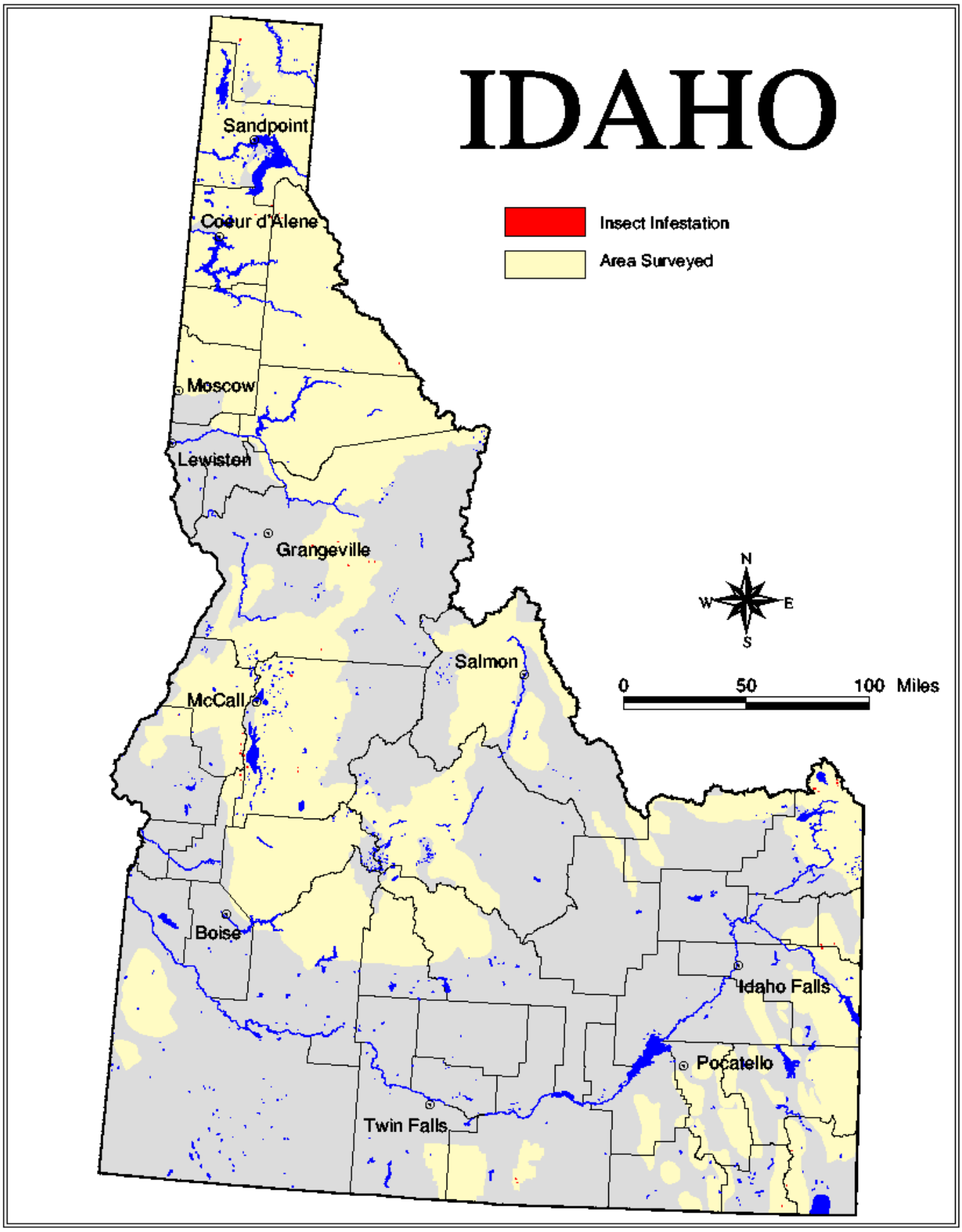
Map 00-1 Areas of Mountain pine beetle infestations in Idaho in 2000



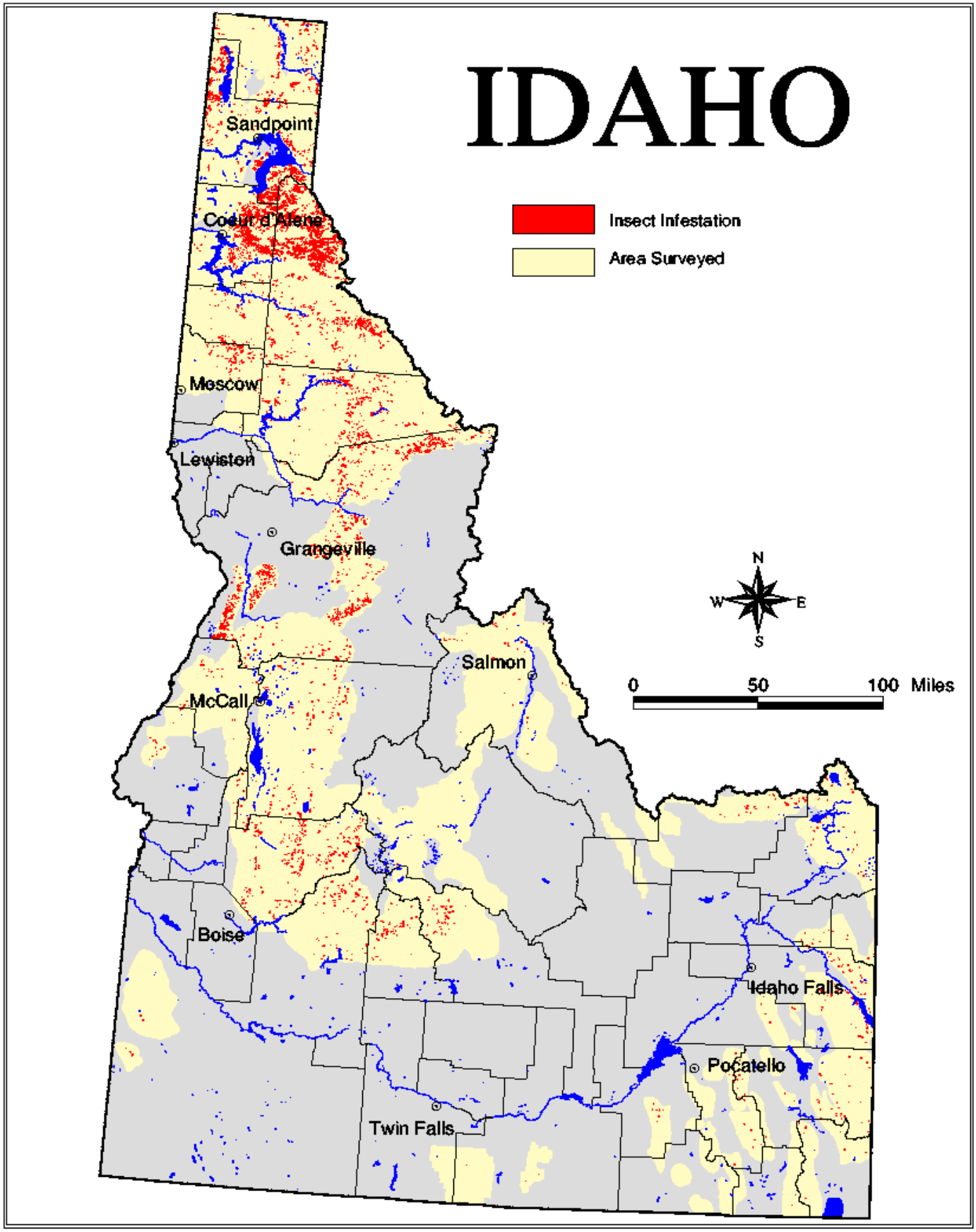
Map 00-2 Areas of Pine engraver beetle infestations in Idaho in 2000



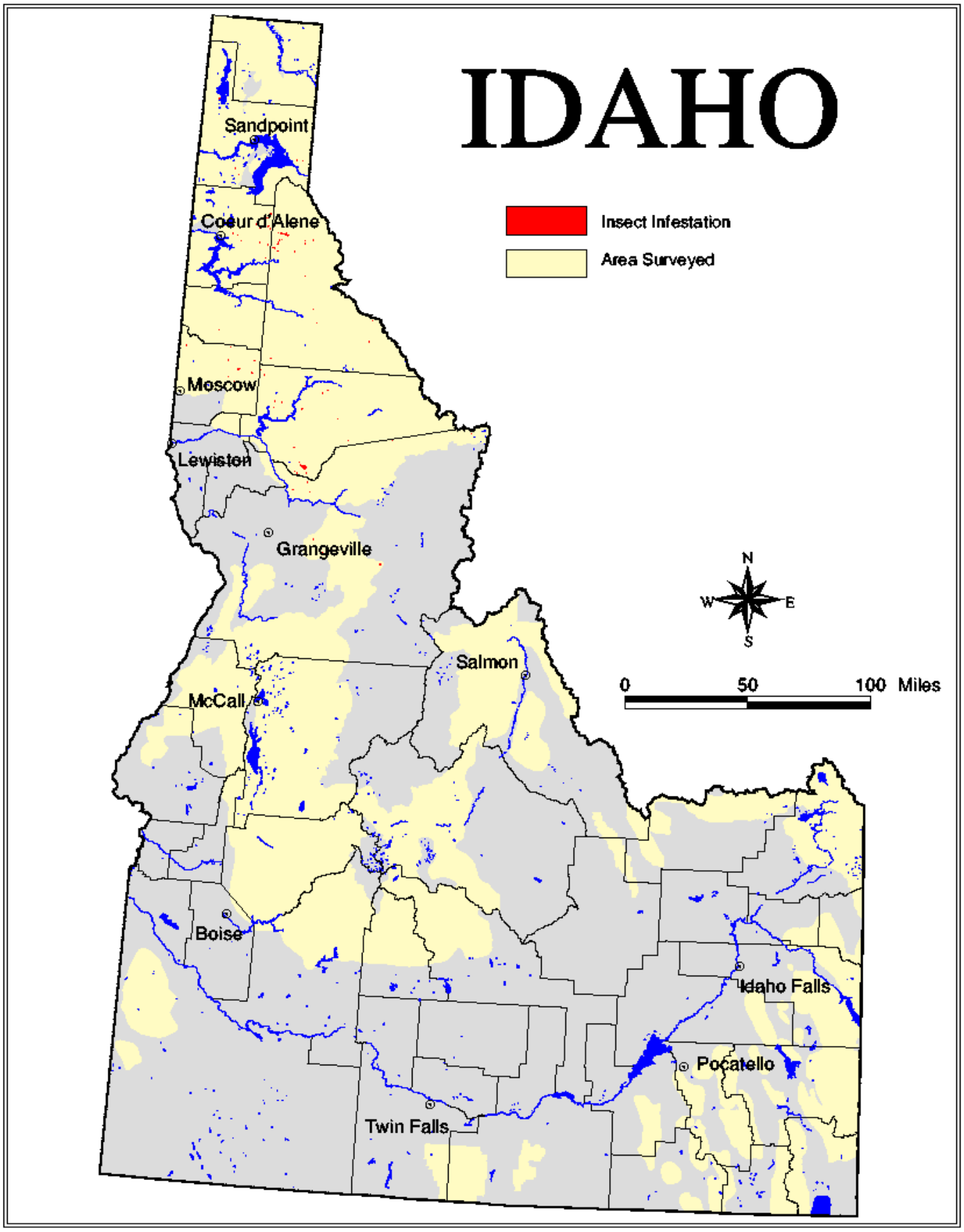
Map 00-3 Areas of Western pine beetle infestations in Idaho in 2000



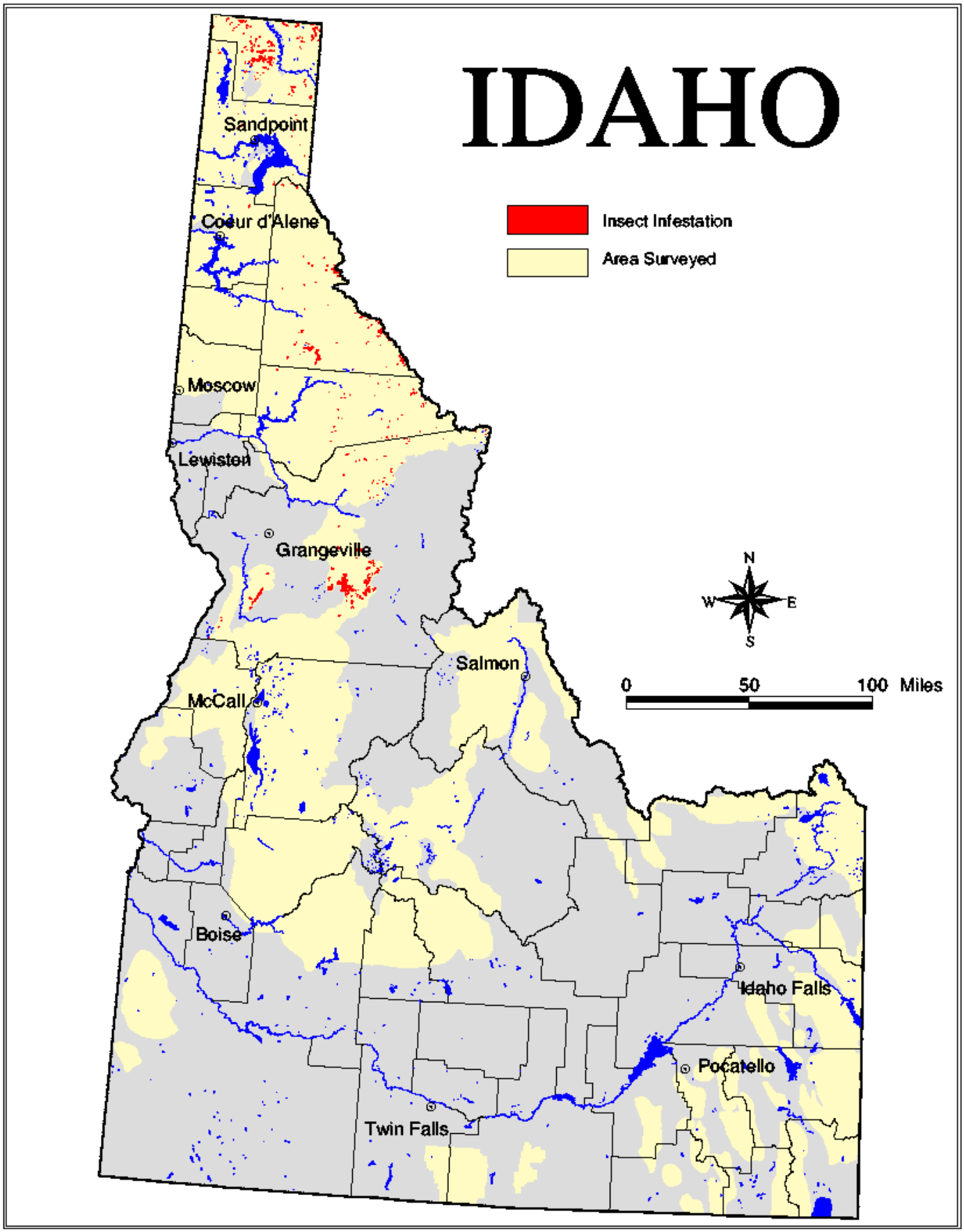
Map 00-4 Areas of Spruce beetle infestations in Idaho in 2000



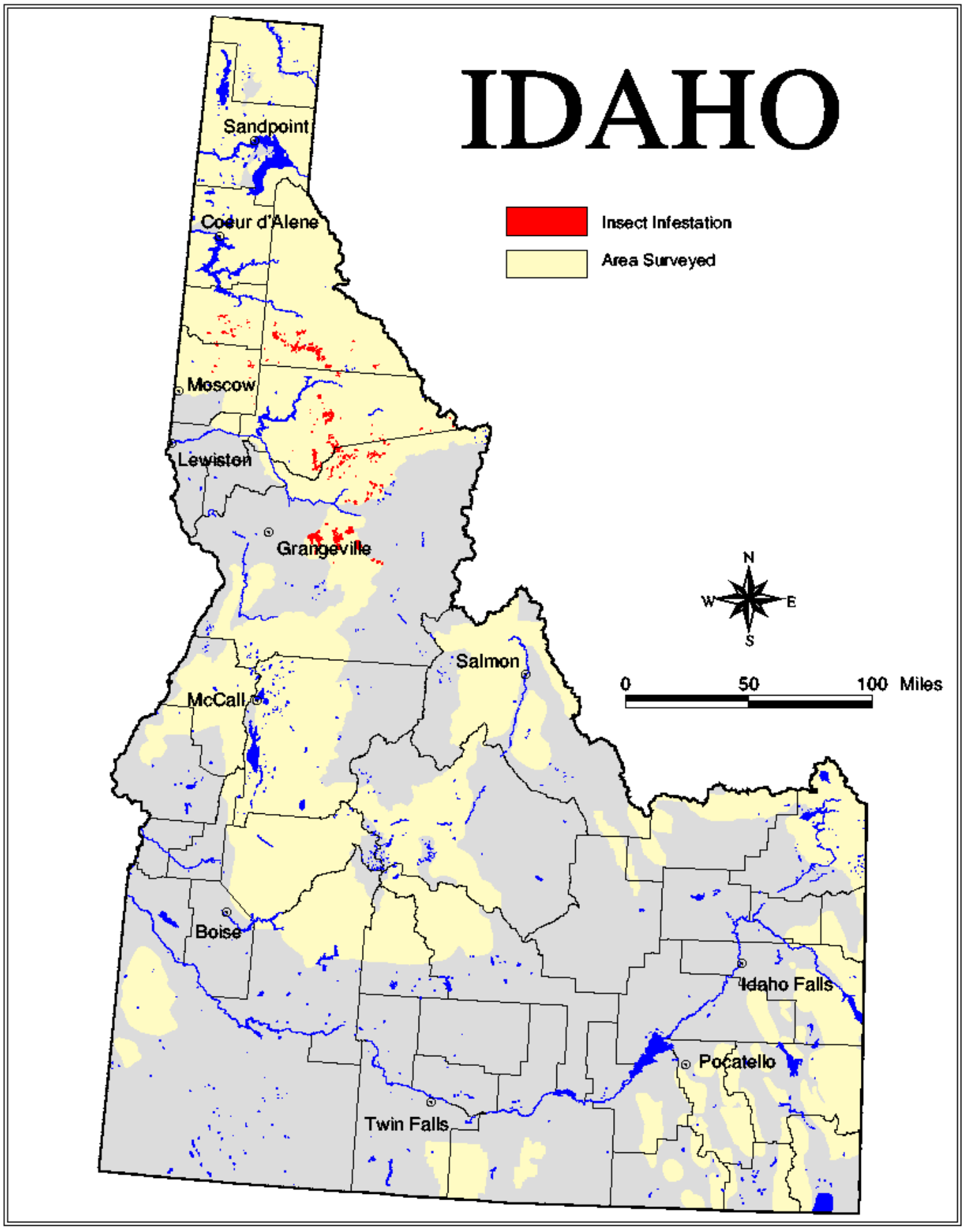
Map 00-5 Areas of Douglas-fir beetle infestations in Idaho in 2000



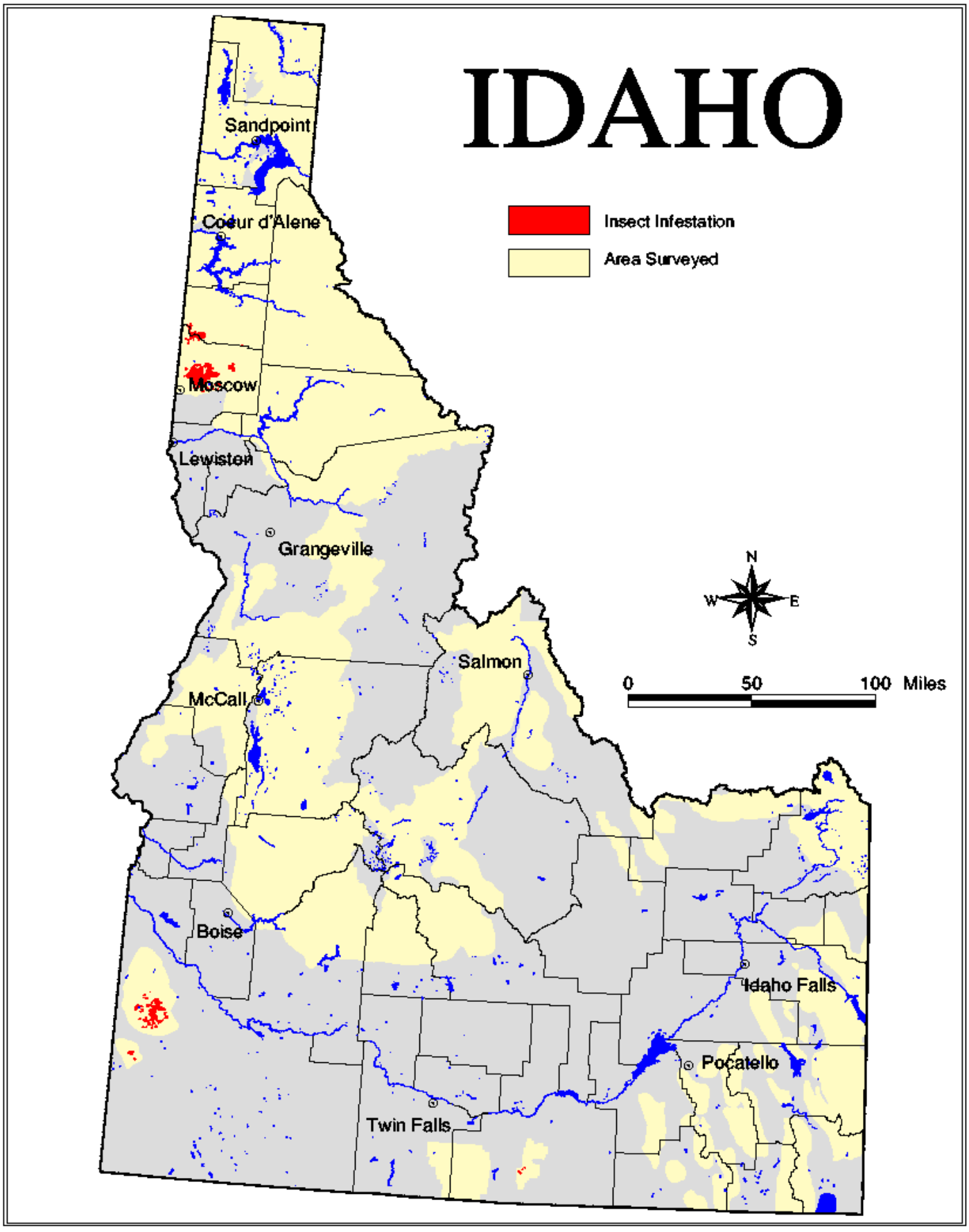
Map 00-6 Areas of Fir engraver beetle infestations in Idaho in 2000



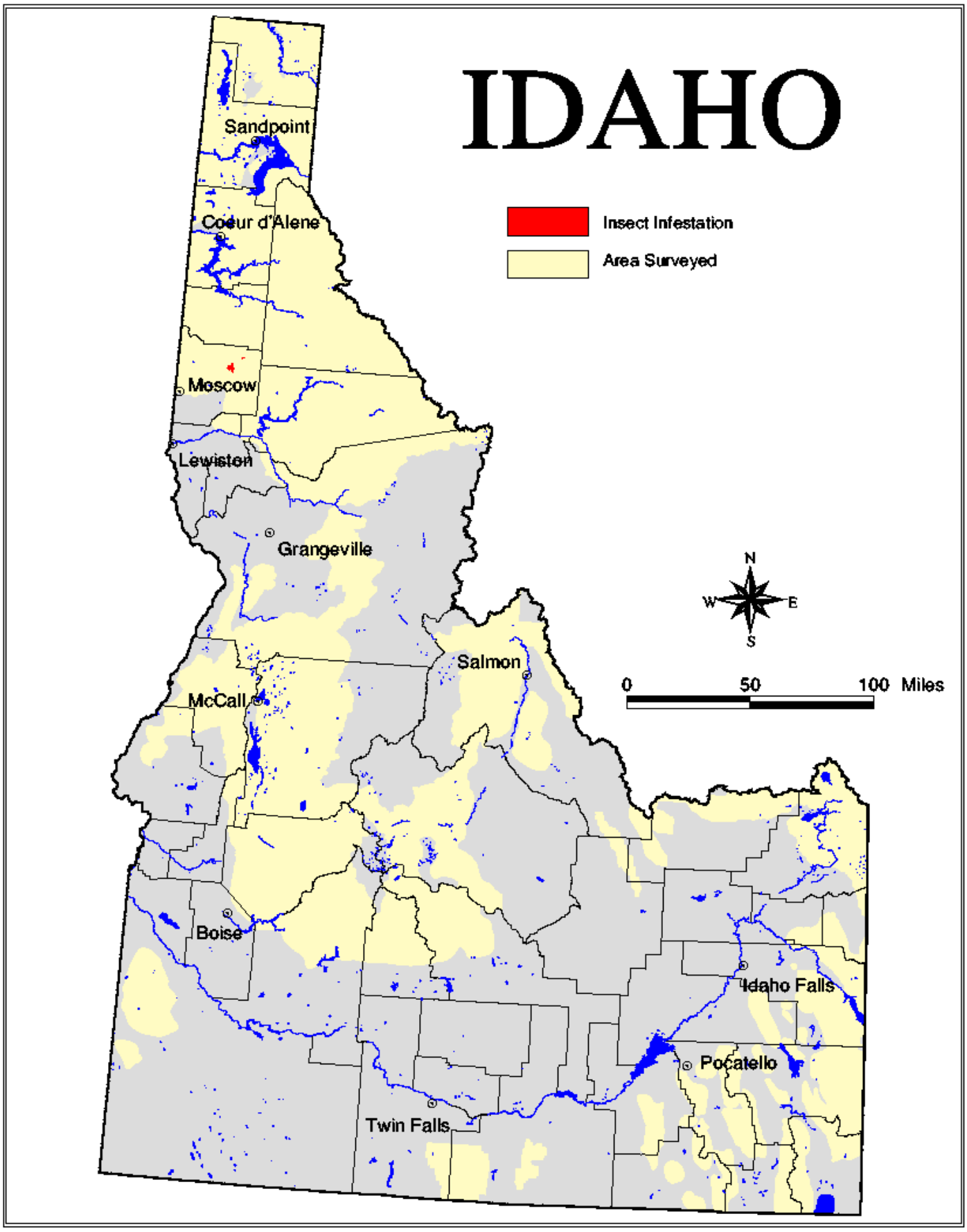
Map 00-7 Areas of Western balsam bark beetle infestations in Idaho in 2000



Map 00-8 Areas of Balsam Woolly Adelgid infestations in Idaho in 2000



Map 00-9 Areas of Douglas-fir Tussock Moth infestations in Idaho in 2000



Map 00-10 Areas of Hemlock Looper infestations in Idaho in 2000